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Final Environmental Impact Statement and Report North Monterey County Facilities Plan Volume II: Appendices

Monterey Peninsula Water Pollution Control
Agency, CA

Prepared for

Environmental Protection Agency
San Francisco

Aug 77

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NTIS

PB82-202300

Appendices to Final Environmental Impact Statement and Report

North Monterey County Facilities Plan

Vol. II

August 1977

U.S. Environmental Protection Agency
Monterey Peninsula Water Pollution Control Agency

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NORTH MONTEREY COUNTY FACILITIES PLAN

AUGUST 1977

Volume II

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PREFACE

Volume II of the Final EIS/EIR for the North Monterey County Facilities Plan includes the unrevised appendices of the Draft EIS/EIR as published in April 1977. Any changes in or additions to this material made in the process of preparing the Final EIS/EIR are included in the "Changes in the Text of the Draft EIS/EIR" section of Volume I. Volume I and Volume II together constitute the entire North Monterey County Facilities Plan Final EIS/EIR.

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BACKGROUND DATA -- PHYSICAL ENVIRONMENT

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AIR QUALITY

APPENDIX A-1

BACKGROUND INFORMATION ON AIR POLLUTION

Introduction

Any detailed discussion of air pollution issues requires an understanding of terms and phrases which are used in a technical or semi-technical sense. It is especially important to understand the distinction between air pollutant emissions and ambient air quality. The term "pollutant emissions" refers to the quantity of one or more specific compounds introduced into the atmosphere by a given source (or group of sources) during a specified time period. The term "ambient air quality" refers to the concentration (quantity per unit volume) of a specific compound in the atmosphere which results from the interaction of pollutant emissions, physical processes (meteorology) affecting the distribution of these pollutants, and chemical reactions in the atmosphere involving these pollutants. Thus, emissions represent the rate (amount per unit time) at which pollutants are added to the atmosphere, while air quality is the concentration (amount per unit volume of air) of a pollutant actually experienced at a particular geographic location.

It is customary to identify air pollutants either as specific chemical compounds (such as carbon monoxide [CO], nitric oxide [NO], nitrogen dioxide [NO_2], hydrogen sulfide [H_2S], sulfur dioxide [SO_2], sulfuric acid [H_2SO_4], ozone [O_3], hydrogen fluoride [HF], ethylene [C_2H_4], lead [Pb]) or as certain groups of compounds (such as total oxides of nitrogen [NO_x], oxides of sulfur [SO_x], photochemical oxidants [O_x], suspended particulates or aerosols, nitrates [NO_3^-], sulfates [$SO_4^=$], organic gases or hydrocarbons [HC]). As indicated above, some pairs of terms are often used interchangeably. The terms "aerosols" and "suspended particulate matter" are generally used as synonyms. Likewise, the terms "hydrocarbons" and "organic gases" are often used interchangeably. The term "organic gases" is usually more appropriate from a strictly technical standpoint than is the term "hydrocarbons".

Air pollutants, such as those identified above, are often categorized as being "primary" or "secondary" pollutants. Primary pollutants are those (such as CO, NO, H_2S, most SO_2, HF, Pb, and various aerosols and organic gases) which are emitted directly into the atmosphere. Secondary pollutants are those (such as most NO_2, H_2SO_4, O_3, NO_3^-, $SO_4^=$, and many aerosols and organic gases) which are produced from primary pollutants or other secondary pollutants by chemical reactions in the atmosphere. These chemical reactions may also involve compounds which are normal components of the atmosphere. Compounds which readily participate in such chemical reactions are often categorized as "reactive pollutants".

On a global scale, natural sources produce far greater quantities of most pollutants than do human activities. Yet because these natural sources are far less concentrated than human activities, they exert little impact on ambient air quality (Table A).

Meteorology

Meteorological factors are important to consider from several perspectives when evaluating air quality issues. Factors such as temperature, humidity, and the intensity and duration of sunlight play important roles in governing the nature and rate of chemical reactions in the atmosphere. Atmospheric turbulence, wind patterns and vertical temperature gradients are important factors governing the distribution and dispersion of pollutants. Atmospheric turbulence, wind patterns and precipitation processes affect the rate at which pollutants are removed from the atmosphere. Figure A summarizes the major structural features of the atmosphere.

Temperature Inversions

Under "normal" conditions, sunlight warms land surfaces which in turn heat the air at ground level by conduction and re-radiation of heat. When heated sufficiently, a pocket or "cell" of warmed air will expand and rise, being displaced by cooler, denser air from above. As it rises, the cell of warm air will expand further due to decreasing atmospheric pressure. This expansion due to decreasing pressure at higher altitudes causes the temperature of the air cell to drop. The air cell will continue to rise, expand in volume, and cool until it reaches an altitude where it is at the same temperature and pressure as surrounding air masses. This rising of warmed air and replacement by cooler air from above results in vertical mixing of the air column.

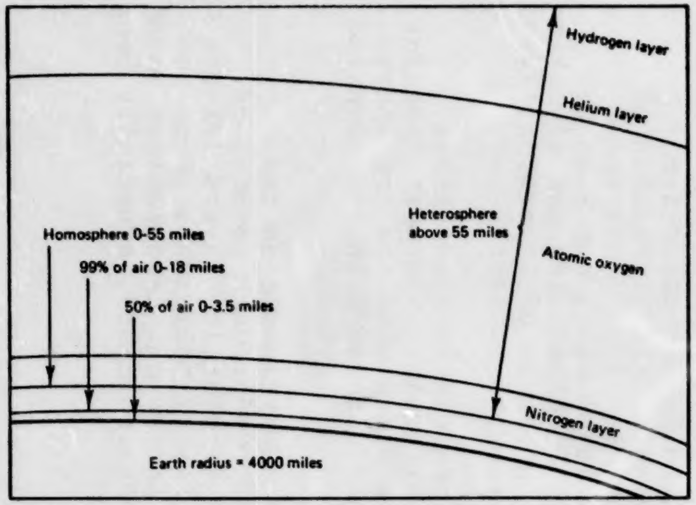
If, however, the air near ground level becomes colder (and thus denser) than the higher air masses, this vertical mixing ceases and a temperature inversion is formed -- air temperature increases with altitude. An inversion can form under a wide variety of circumstances. Radiation inversions often form during clear nights when the land surface cools faster than the air above it. Air at ground level thus cools

Table A

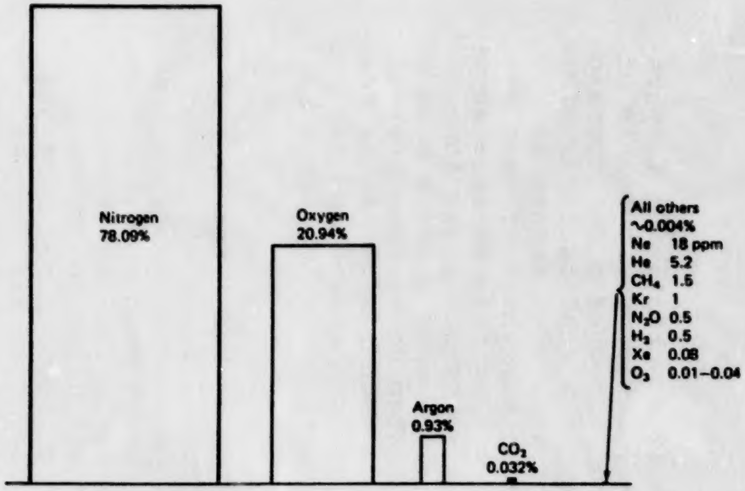
SUMMARY OF ANNUAL GLOBAL NATURAL AND MAN-CAUSED EMISSIONS OF MAJOR AIR POLLUTANTS

Contaminant	Major Pollution Sources	Natural Sources	Estimated Emissions (tons)		Atmospheric Background Concentrations	Calculated Atmospheric Residence Time	Removal Reactions and Sinks	Remarks
			Pollution	Natural				
SO_2	Combustion of coal and oil	Volcanoes	146×10^6	No estimate	0.2 ppb	4 days	Oxidation to sulfate by ozone or, after absorption, by solid and liquid aerosols	Photochemical oxidation with NO_2 and HC may be the process needed to give rapid transformation of $SO_2 \rightarrow SO_4$
H_2S	Chemical processes, sewage treatment	Volcanoes, biological action in swamp areas	3×10^6	100×10^6	0.2 ppb	2 days	Oxidation to SO_2	Only one set of background concentrations available
CO	Auto exhaust and other combustion	Photochemical oxidation of methane, forest fires, oceans, terpene reactions, volcanoes, decomposition of chlorophyll	304×10^4	3.47×10^9	0.1 ppm	1-4 months	Probably soil organisms and reaction with hydroxyl radical in stratosphere; possibly oxidation by NO_3	Ocean contributions to natural source probably low. Removal mechanisms poorly studied
NO/NO_2	Combustion	Bacterial action in soil (?)	53×10^6	NO: 430×10^6 NO_2: 658×10^6	NO: 0.2-2 ppb NO_2: 0.5-4 ppb	5 days	Oxidation to nitrate after sorption by solid and liquid aerosols, hydrocarbon photochemical reactions	Very little work done on natural process
NH_3	Waste treatment	Biological decay	4×10^6	1160×10^6	6 ppb to 20 ppb	7 days	Reaction with SO_2 to form $(NH_4)_2SO_4$ oxidation to nitrate	Formation of ammonium salts is major NH_3 sink
Hydrocarbons	Combustion exhaust, chemical processes	Biological processes	88×10^6	CH_4: 1.6×10^9 Terpenes: 200×10^6	CH_4: 1.5 ppm Non CH_4: <1 ppb	4 years (CH_4)	Photochemical reaction with NO/NO_2, O_3; large sink necessary for CH_4	"Reactive" hydrocarbon emissions from pollution equals 27×10^6 tons
CO_2	Combustion	Biological decay, release from oceans	1.4×10^{10}	10^{12}	325 ppm	2-4 years	Biological adsorption and photosynthesis, adsorption in oceans	Atmospheric concentrations increasing by 0.7 ppm/year

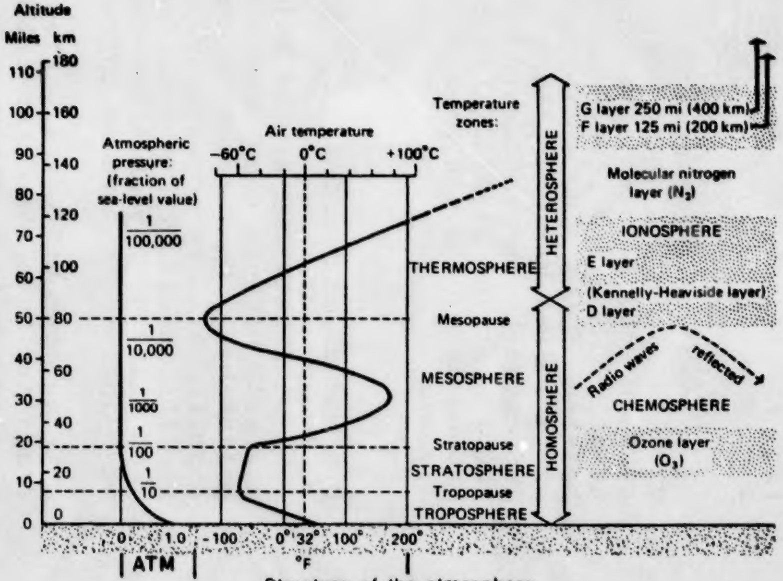
Source: Modified from E. R. Robinson and R. C. Robbins, 1972 (In: W. Strauss, ed., Part II), based on Urone, 1976 and Whelpdale and Munn, 1976.


Hydrogen layer
Helium layer
Heterosphere above 55 miles
Atomic oxygen
Homosphere 0-55 miles
99% of air 0-18 miles
50% of air 0-3.5 miles
Nitrogen layer
Earth radius = 4000 miles

Vertical distribution of air



Composition of dry air (% v/v).


Altitude
Miles km
110
100
90
80
70
60
50
40
30
20
10
0
180
160
140
120
100
80
60
40
20
0
Atmospheric pressure: (fraction of sea-level value)
1/100,000
1/10,000
1/1000
1/100
1/10
0
1.0
ATM
Air temperature
−60°C
0°C
+100°C
- 100
0°
32°
100°
200°
°F
Temperature zones:
THERMOSPHERE
Mesopause
MESOSPHERE
Stratopause
STRATOSPHERE
Tropopause
TROPOSPHERE
HETEROSPHERE
HOMOSPHERE
G layer 250 mi (400 km)
F layer 125 mi (200 km)
Molecular nitrogen layer (N_2)
IONOSPHERE
E layer
(Kennelly-Heaviside layer)
D layer
Radio waves
reflected
CHEMOSPHERE
Ozone layer (O_3)

Structure of the atmosphere

FIGURE A: STRUCTURE AND COMPOSITION OF THE ATMOSPHERE

Source: Modified from Urone, 1976.

more rapidly than air at higher altitudes, creating a temperature inversion. In mountainous areas, downslope movements of dense, cold air from higher elevations can create an inversion condition in valley areas. An influx of a shallow layer of cold air under a larger warm air mass will also create an inversion condition; this occurs frequently wherever cool sea breezes are common. A warm air mass moving into an area above a cold air mass at ground level can also create inversion conditions. A subsidence inversion forms when a large mass of air within a stagnant high pressure system sinks down over an area and is warmed by compression to a temperature higher than that of the surface air mass. This occurs because, as air from the center of a cell spreads outward, it is replaced by a sinking air mass from above.

Temperature inversions can form at ground level or at various altitudes above the land surface (Figure B). Both surface and elevated inversion layers may be present simultaneously. Surface inversions tend to break with normal daytime heating of the land while inversions aloft tend to be more persistent. The "magnitude" or strength of an inversion is indicated by the temperature difference between the base and the top of the inversion layer. The layer of air between ground level and the base of an inversion is called the "mixing layer".

Wind Patterns and Mixing of Pollutants

Wind patterns are of major concern in air pollution analysis because they govern the transport and dispersion of pollutants. Wind patterns near ground level are influenced significantly by topography. Ground level winds may also be significantly different (in regard to both velocity and direction) from winds at higher altitudes. The presence of inversion layers also influences, and is influenced by, wind patterns.

Several different patterns of long distance pollutant transport have been identified in California. The most frequent pattern involves transport by surface winds with the transported pollutants being mixed with pollutants generated in the downwind "receptor" areas.

Heating of interior valleys and mountain slopes can carry pollutants to higher altitudes. Under such conditions, pollutants often become concentrated in district layers (Figure C). If an elevated inversion layer is present, pollutants often concentrate just below the base of the inversion, or sometimes within the inversion layer. Breaks in inversion layers, especially over

Figure B

Typical Temperature/Altitude Profiles

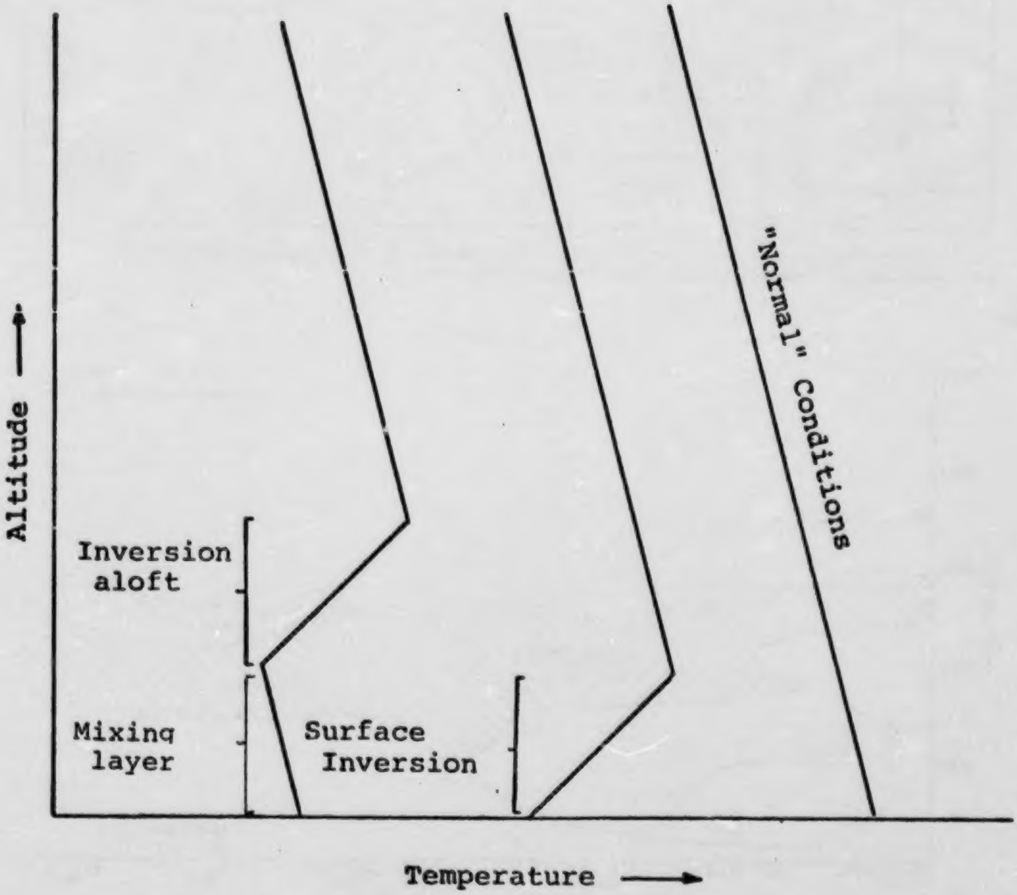
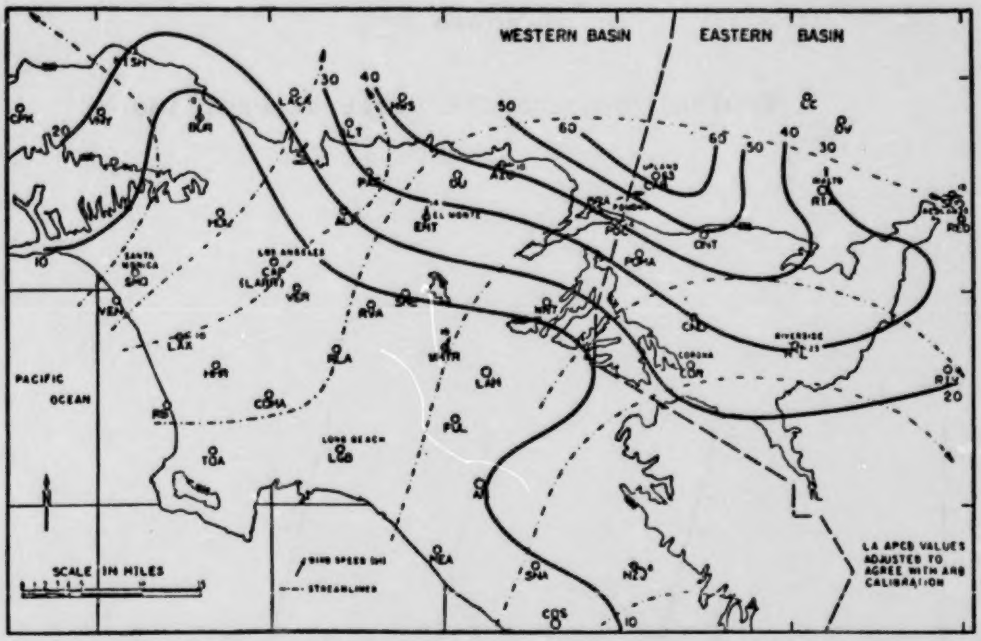
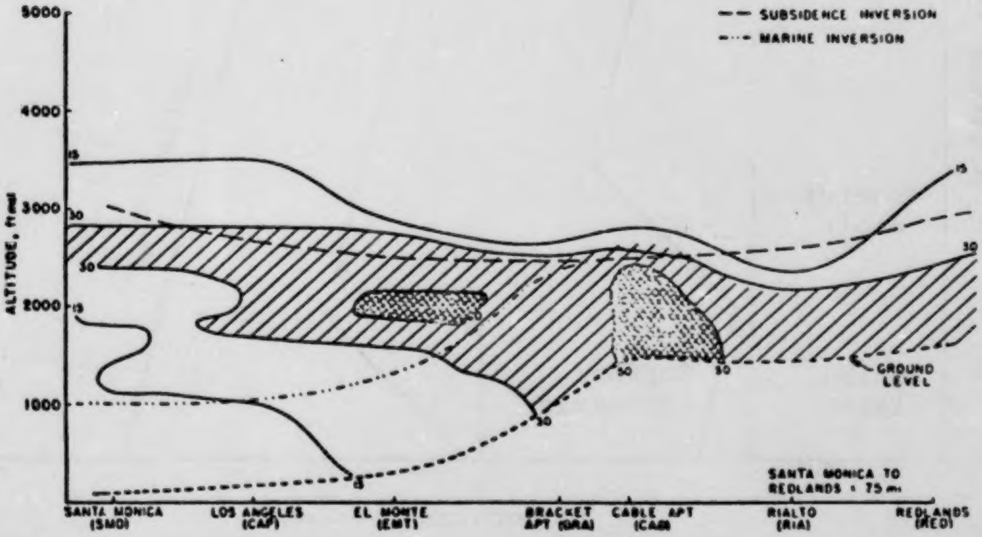


Figure C

OXIDANT DISTRIBUTION ON JULY 25, 1973


WESTERN BASIN
EASTERN BASIN
PACIFIC OCEAN
SANTA MONICA
LOS ANGELES
EL MONTE
LONG BEACH
RIVERSIDE
CORONA
UPLAND
SCALE IN MILES
WIND SPEED (M)
STREAMLINES
LA APCD VALUES ADJUSTED TO AGREE WITH ARB CALIBRATION
10
20
30
40
50
60

Surface ozone concentrations (pphm) 4:00-5:00 p.m. PDT and 4:00 p.m. PDT streamlines, July 25, 1973, in the South Coast Air Basin between sea level and the surrounding mountains.



Vertical cross section of ozone concentration (pphm) for late afternoon (4:30-6:30 p.m. PDT) July 25, 1973, in the South Coast Air Basin between sea level and the surrounding mountains.

Source: Blumenthal, 1976.

areas of elevated terrain, can allow pollutants to be carried to altitudes above the top of the inversion or to be returned to ground level through turbulent mixing where the inversion has broken.

Pollutants carried in elevated strata can also be returned to ground level during periods of nighttime cooling, especially if the pollutants concentrate against mountain slopes. Pollutants which are transported to altitudes above the top of an inversion may be transported long distances by high altitude winds (which may flow counter to surface winds). Breaks in the inversion layer may subsequently return these pollutants to ground level.

Under certain conditions of generally light surface winds, pollutants may concentrate in a source area and be transported in-mass to a downwind area with little dilution occurring during transport. The transported mass of polluted air may also displace, rather than mix with, the air mass in the downwind receptor area.

Air Pollution Chemistry

Sulfur Compounds

Most air pollutant emissions of sulfur compounds are in the form of sulfur dioxide (SO_2), with smaller amounts being emitted as hydrogen sulfide (H_2S) or sulfur trioxide (SO_3). In the atmosphere, hydrogen sulfide is readily oxidized to sulfur dioxide. In "clean" air, SO_2 oxidizes slowly to SO_3; this reaction proceeds more rapidly in the heated exhaust plume from a combustion source. The oxidation of SO_2 to SO_3 is catalyzed (accelerated) by the presence of metallic particulates, especially iron and manganese salts, and by water vapor. This catalyzed reaction occurs most readily in droplets of water condensed around the metallic particulates. The oxidation of SO_2 to SO_3 is also enhanced by the presence of various intermediate chemicals which are created during the formation of photochemical oxidants (smog), and is inhibited by nitrogen dioxide.

Sulfur trioxide combines rapidly with water vapor to form sulfuric acid (H_2SO_4). Sulfuric acid reacts readily with various metal ions or atmospheric ammonium to form particulate sulfates, especially ammonium sulfate and calcium sulfate.

Oxides of Nitrogen

Seven different oxides of nitrogen are known to exist, but only two, nitric oxide (NO) and nitrogen dioxide (NO_2) are significant air pollutants. Nearly all pollutant emissions of nitrogen oxides occur as nitric oxide. Nitric oxide is generated by high temperature combustion of organic nitrogen compounds or by thermal fixation of nitrogen gas (N_2), which comprises 78 percent of air. Nitric oxide molecules can spontaneously decompose into nitrogen gas and oxygen (O_2), but the rate of this reaction is extremely slow at normal air temperatures. Most frequently, nitric oxide is oxidized to nitrogen dioxide, either slowly by atmospheric oxygen or rapidly by natural concentrations of ozone (O_3).

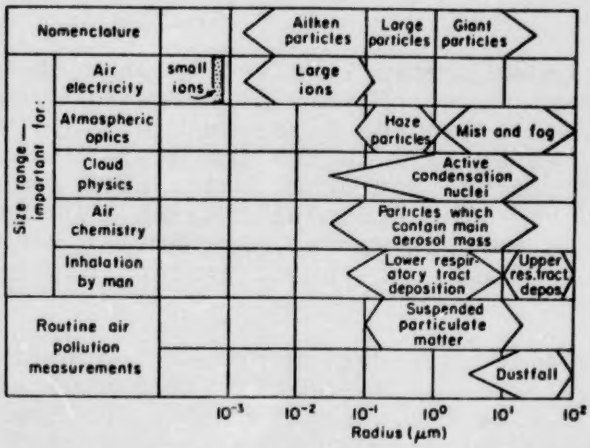
Nitrogen dioxide is rapidly oxidized by ozone, producing nitrogen trioxide (NO_3), which combines with NO_2 to form nitrogen pentoxide (N_2O_5). Nitrogen pentoxide combines readily with water vapor to form nitric acid (HNO_3). In fog droplets, nitrogen dioxide can be hydrated and catalytically oxidized directly to nitric acid. Nitric acid reacts readily with metal ions and atmospheric ammonium to form particulate nitrate salts. A reaction between nitrogen trioxide and carbon monoxide to produce nitrogen dioxide and carbon dioxide has recently been suggested by some researchers (Willix, 1976).

Several of the above compounds are photochemically active, undergoing various chemical reactions after absorbing energy from sunlight. Nitrogen dioxide in particular plays a major role in photochemical reactions (discussed below).

Aerosols

The term aerosols is applied to the whole range of solid or liquid particles that occur in the atmosphere. Some aerosols are living organisms or are derived from living organisms (i.e., pollen grains, viruses, bacteria, algae, protozoa, molds, fungi, yeasts, spores, etc.); these are often referred to as "viable particulates". Non-viable particulates are often classified as dispersion aerosols (formed by grinding or atomization of solids and liquids) or as condensation aerosols (formed when supersaturated or saturated vapors condense, or by chemical reactions among gases to form a volatile or non-volatile solid product). Aerosol sizes are often measured in units of microns (μm). One micron equals 1/1,000 millimeter, or slightly less than 4/100,000 inches (3.94×10^{-5} inches). Figure D illustrates additional aspects of terminology and the importance of aerosols in different size ranges.

Figure D. Terminology and Importance of Natural Aerosols.



Nomenclature
Aitken particles
Large particles
Giant particles
Size range — important for:
Air electricity
small ions
Large ions
Atmospheric optics
Haze particles
Mist and fog
Cloud physics
Active condensation nuclei
Air chemistry
Particles which contain main aerosol mass
Inhalation by man
Lower respiratory tract deposition
Upper res.tract depos.
Routine air pollution measurements
Suspended particulate matter
Dustfall
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Radius (μm)

Source: Corn, 1976.

The importance of aerosols in terms of atmospheric chemistry depends largely on the size and shape, surface electrical charge, and chemical composition of aerosol particles. Particle shapes are often classified as spherical, cubical, irregular, flakes, fibrous, or condensation flocks. Aerosols participate in chemical reactions in three different ways: by providing either a dry substrate or an aqueous environment in which other chemicals react; by participating in reactions as a catalyst; and by direct involvement as a primary reactant.

Photochemical Reactions

Photochemical reactions are those in which the energy content of sunlight (and ultraviolet radiation in particular) is absorbed by a compound and provides the activation energy necessary to initiate a variety of chemical reactions. The energy content of light depends upon its wavelength; the shorter the wavelength the higher the energy content. The stratospheric ozone layer generally prevents wavelengths below 2,900 angstroms (1 angstrom equals 10^{-10} meters, or 10^{-4} microns) from reaching the earth's surface.

If exposed to light of a short enough wavelength, a large number of chemicals will be decomposed. Compounds known to undergo photochemical decomposition in the lower atmosphere include nitrogen dioxide (NO_2), nitrous acid (HNO_2), nitric acid (HNO_3), hydrogen peroxide (H_2O_2), and various organic peroxides, aldehydes, ketones, and organic nitrates. Such photochemical decomposition usually leaves one or more of the decomposition products in a highly energized or reactive state.

Nitrogen oxides become involved in photochemical reactions in several ways. Nitric oxide reacts with ozone to produce molecular oxygen and nitrogen dioxide. This reduces oxidant levels, especially in the immediate vicinity of freeways, power plants, and other major high-temperature combustion sources. The nitrogen dioxide thus formed, however, participates in a complex series of chemical reactions leading to the formation of numerous photochemical oxidants, including ozone.

The photochemical oxidation process normally begins with the photochemical decomposition of nitrogen dioxide into nitric oxide and a free oxygen atom (O). Following this initial step, numerous organic gases, water vapor, nitrogen oxides, oxygen and ozone take part in a lengthy series of interdependent chemical reactions. During the course of these reactions, some of the nitrogen dioxide which initiated the process is converted to various complex organic nitrates. Most NO_2, however, serves only as an intermediate reactant and is eventually regenerated as nitrogen dioxide. This regenerated nitrogen dioxide is then available to initiate another sequence of photochemical reactions. Table B summarizes the current state of knowledge about some of the more important reactions which are believed to occur in the photochemical oxidation process.

The major products of the photochemical oxidation process are ozone, aldehydes (especially formaldehyde and acrolein), ketones, peroxyacyl nitrates (especially peroxyacetyl nitrate or PAN), organic nitrates, organic peroxides, hydrogen peroxides, carbon dioxide, and carbon monoxide. Ozone is normally the major product, but is so chemically reactive that high levels can be maintained in polluted air only while it is being continuously generated by the photochemical oxidation process. Thus, ozone levels rapidly decline at night or during cloudy weather. High ozone levels may persist throughout the night or for a few days if a mass of smog is transported into an area having few local pollution sources. This situation is due to the absence of other chemicals with which ozone can react.

Table B

REACTION RATES FOR IMPORTANT STEPS IN THE PHOTOCHEMICAL OXIDATION PROCESS

Reaction	Comments
1. $NO_2 + h\nu \rightarrow NO + O$	$k_a\emptyset$ uncertain by ~20%; difficulties encountered in trying to relate measured k_d to $k_a\emptyset$
2. $O + O_2 + M \rightarrow O_3 + M$	Well known; $k = 2.0 \times 10^{-5}$ ppm^{-2} min^{-1}
3. $O_3 + NO \rightarrow O_2 + NO_2$	$20 \leq k \leq 40$ ppm^{-1} min^{-1}
4. $O_3 + NO_2 \rightarrow NO_3 + O_2$	Two measured values, 0.11 and 0.048 ppm^{-1} min^{-1}, both of which may be too high
5. $NO_3 + NO_2 \rightarrow N_2O_5$	k_5 and k_6 uncertain by ~20%; equilibrium constant is very temperature dependent
6. $N_2O_5 \rightarrow NO_3 + NO_2$	
7. $N_2O_5 + H_2O \rightarrow 2HNO_3$	Reaction in gas phase is negligible; reaction occurs only on surfaces
8. $NO_3 + NO \rightarrow 2NO_2$	k factor of 10^2 uncertainty; most important NO_3 removal process
9. $NO_3 + h\nu \rightarrow NO_2 + O$	Importance not determined
10. $NO + NO_2 + H_2O \rightarrow 2HONO$	Rate may be higher than first order with respect to H_2O; heterogeneous contributions to this rate not determined
11. $2HONO \rightarrow NO + NO_2 + H_2O$	
12. $HONO + h\nu \rightarrow OH + NO$	$k_{12} \sim 0.1\, k_a\emptyset$; photolysis of HONO in early morning may initiate smog formation
13. $OH + NO_2 + [M] \rightarrow HNO_3 + [M]$	k uncertain; order of reaction depends on pressure of M; probably second order in atmosphere
14. $OH + NO + [M] \rightarrow HONO + [M]$	k uncertain; pressure dependence not determined
15. $OH + CO \rightarrow CO_2 + H$	$230 \leq k \leq 280$ ppm^{-1} min^{-1}; reaction is too slow to compete with olefin–OH reactions
16. $H + O_2 + M \rightarrow HO_2 + M$	Only atmospheric reaction of importance for H atoms
17. $HO_2 + NO \rightarrow HO + NO_2$	$10^2 \leq k \leq 10^3$ ppm^{-1} min^{-1}; most important HO_2 removal process
18. $2HO_2 \rightarrow H_2O_2 + O_2$	k uncertain by ~50%
19. $H_2O_2 + h\nu \rightarrow 2OH$	Photolysis rate in sunlight not well known
20. Paraffins + O → R + OH	k uncertain by ~ factor of 10
21. Paraffins + OH → R + H_2O	k uncertain by ~ factor of 10
22. Olefins + O → ?	k factor of 2 uncertainty; products of reaction under atmospheric conditions unknown
23. Olefins + OH → ?	Most important olefin reaction; products of reaction unknown
24. Olefins + O_3 → aldehyde + zwitterion	k factor of 2 uncertainty; reactions of switterion unknown
25. Olefins + H_2O → ?	Probably unimportant
26. Aromatics + O → R + OH	k's for most reactions unknown; $k_{26} \sim k_{20}$
27. Aromatics + OH → R + H_2O	k's for most reactions unknown
28. $RCHO + h\nu \rightarrow R + HCO$	Quantum yields as function of $h\nu$ not well known; k_{28} may be an important chain initiation step in atmosphere
29. $RCHO + h\nu \rightarrow RH + CO$	
30. $RCHO + OH \rightarrow RCO + H_2O$	$k \sim 10^4$ ppm^{-1} min^{-1}
31. $RCHO + O \rightarrow RCO + OH$	Slow compared to R. 30
32. $HCO + O_2 \rightarrow HO_2 + CO$	k high; only important HCO reaction
33. $RCO + O_2 \rightarrow RC(O)OO$	Only RCO reaction of importance
34. $RC(O)OO + NO \rightarrow R + CO_2 + NO_2$	k unknown
35. $RC(O)OO + NO_2 \rightarrow RC(O)OONO_2$	k unknown
36. $R + O_2 \rightarrow RO_2$	Very fast
37. $RO_2 + NO \rightarrow RO + NO_2$	k unknown
38. $RO_2 + NO_2 \rightarrow RO_2NO_2$	k unknown
39. $RO_2 + HO_2 \rightarrow ROOH + O_2$	k unknown
40. $RO + O_2 \rightarrow RCHO + HO_2$	k unknown
41. $RO + NO \rightarrow RONO$	k unknown
42. $RO + NO_2 \rightarrow RONO_2$	k unknown

NOTES:
$h\nu$ light energy
M energy absorbing molecule or catalyst
R hydrogen atom or hydrocarbon group

Source: Hecht, 1973, as presented in Haagen-Smit and Wayne, 1976.

Under certain conditions the initial photochemical reaction during which nitrogen dioxide is decomposed can be replaced by the photochemical decomposition of various organic compounds, halogens or metal oxides (Haagen-Smit and Wayne, 1976). Haagen-Smitt and Wayne (1976) cite Adams and Schneider (1952) as documenting an instance where the combined emissions of styrene ($C_6H_5CHCH_2$) and halogens produced eye irritants through a photochemically catalyzed process.

Paskind and Kinosian (1974) present evidence that oxidant levels depend on not only the absolute amounts, but also the ratio between hydrocarbon and nitrogen oxide levels. Oxidant levels will increase or decrease with corresponding changes in hydrocarbon levels. A change in nitrogen oxide levels (either increase or decrease) may, depending on the relative quantities of hydrocarbons present, produce either an increase or a decrease in oxidant values. This situation is due to the various roles which nitrogen oxides can play during the photochemical reaction process and to the chemical reactivity of ozone. Both Paskind and Kinosian (1974) and Pitts, et.al. (1975) present data suggesting that a reduction of nitrogen oxide levels in such heavily urbanized areas as central Los Angeles and northern Orange Counties will probably enhance rather than reduce the formation of photochemical oxidants (Figure E).

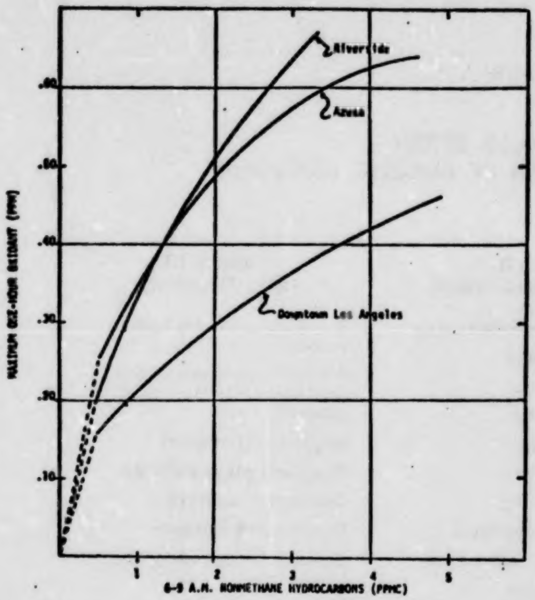
Five major groups of organic gases are normally involved as primary reactants in the photochemical oxidation process: alkanes (paraffins), alkenes (olefins), acetylenes, aromatic hydrocarbons and aldehydes. Several attempts have been made to classify organic gases according to their tendency to participate in photochemical reactions. While differing in details and in the number of reactivity classes used, most studies indicate the following type of classification.

High Reactivity. Internally double-bonded olefins, especially tri- and tetraalkyl ethylenes.
Moderate Reactivity. Polyalkyl benzenes, monoalkyl ethylenes, 1,3-alkadienes.
Low Reactivity. Ethylene, monoalkyl benzenes, alkanes (C_4 and higher).
Negligible Reactivity. Benzene, acetylene, methane, ethane, propane.

Table C presents the reactivity classification currently used by the California Air Resources Board. It should be noted that chemical reactivity is not always correlated with the extent to which a compound or its reaction products cause physiological effects on people, plants or animals.

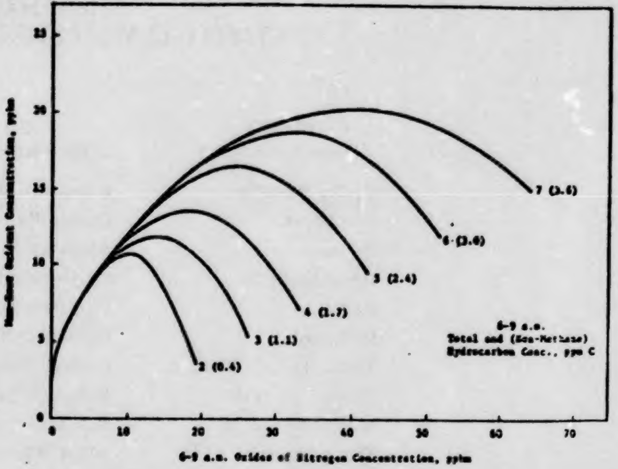
Figure E

NONLINEAR RELATIONSHIPS AMONG HYDROCARBON, NITROGEN OXIDES AND OXIDANT VALUES

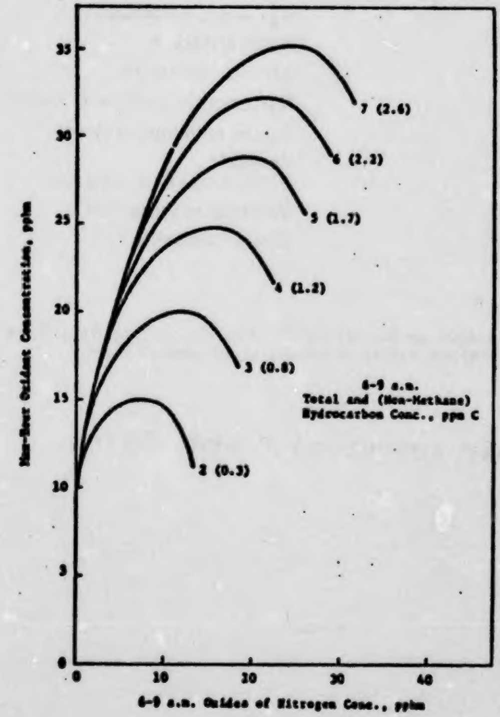


Basis for Schuck/Papetti Oxidant Model

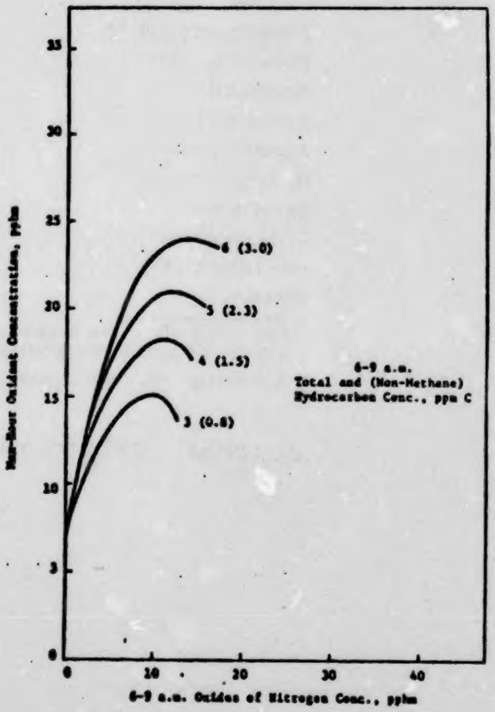
Upper Limit Curves for Three Stations in the Metropolitan Los Angeles AQCR (1)



Pollutant relationships at Los Angeles. Data period: July-Sept. 1969-1972. (2)



Pollutant relationships at Azusa. Data period: July-Sept. 1969-1972. (2)



Pollutant relationships at San Bernardino. Data period: July-Sept. 1969-1972. (2)

Sources: (1) Boundaries and Forecasting Committee, 1976.
(2) Paskind and Kinosian, 1974.

Table C

AIR RESOURCES BOARD
REACTIVITY CLASSIFICATION OF ORGANIC COMPOUNDS

Class I (Low Reactivity)	Class II (Moderate Reactivity)	Class III (High Reactivity)
C_1-C_2 Paraffins	Mono-tert-alkyl-benzenes	All other aromatic hydrocarbons
Acetylene	Cyclic Ketones	All Olefinic hydrocarbons (including partially halogenated)
Benzene	Alkyl acetates	Aliphatic aldehydes
Benzaldehyde	2-Nitropropane	Branched alkyl Ketones
Acetone	C_3+ Paraffins	Cellosolve acetate
Methanol	Cycloparaffins	Unsaturated Ketones
Tert-alkyl alcohols	n-alkyl Ketones	Primary & secondary C_2+ alcohols
Phenyl acetate	N-methyl pyrrolidone	Diacetone alcohol
Methyl benzoate	N,N-dimethyl acetamide	Ethers
Ethyl Amines	Alkyl Phenols*	Cellosolves
Dimethyl formamide	Methyl phthalates**	Glycols*
Perhalogenated Hydrocarbons		C_2+ Alkyl phthalates**
Partially halogenated paraffins		Other Esters**
Phthalic Anhydride**		Alcohol Amines**
Phthalic Acids**		C_3+ Organic acids + di acid**
Acetonitrile*		C_3+ di acid anhydrides**
Acetic Acid		Formin** (Hexa methylene-tetramine)
Aromatic Amines		Terpenic hydrocarbon
Hydroxyl Amines		Olefin oxides**
Naphthalene*		
Chlorobenzenes*		
Nitrobenzenes*		
Phenol*		

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*Reactivity data are either non-existent or inconclusive, but conclusive data from similar compounds are available; therefore, rating is uncertain but reasonable.

**Reactivity data are uncertain.

Source: California Air Resources Board, 1976b.

Pollutant Removal Mechanisms

Pollutants which are added to or formed in the atmosphere are removed through six general mechanisms: gravitational settling; impaction on surfaces; precipitation processes; diffusion into bodies of water; chemical reactions; and biological uptake or metabolism. Primary and secondary aerosols are removed from the atmosphere primarily by the first three processes, while gaseous pollutants are removed primarily by the last four processes.

Removal of Aerosols

The rate at which aerosols settle out of the air depends on the size, weight and shape of the particle, as well as on such meteorological factors as wind speed, vertical temperature gradients and atmospheric turbulence. Spherical particles settle more rapidly than non-spherical particles. In calm air, particles smaller than a few microns in diameter show little or no tendency to settle, being kept in suspension by the random motion of air molecules and similar forces. Small particles will often adhere to each other when they come in contact. Such coagulation of small particles can produce aerosols large enough to settle out of the atmosphere. Aerosols will also adhere to the surface of objects at the earth's surface when blown against them. Removal by impaction occurs most effectively with larger particles and on wet surfaces.

Aerosols larger than about 0.1 micron in diameter are, depending on chemical composition, capable of serving as condensation nuclei in the process of mist, fog or cloud formation. Water-insoluble particles within this size range may also become involved as condensation nuclei following agglomeration with smaller hygroscopic particles or adsorption of water-soluble gases or vapors. Water droplets, ice crystals or snow flakes formed by such processes can be increased in size by continued condensation or by collision and agglomeration of droplets to the point where the resulting drops or flakes fall to earth. "Rainout" of particulates which serve as condensation nuclei represents a major mechanism for removal of aerosols. "Washout" of aerosols occurs when a falling raindrop or snowflake accumulates other particles as it falls. Such washout mechanisms are ineffective in removing particles smaller than 2 microns in diameter, and are most effective in removing particles which have become wetted by condensation of water vapor or other gases.

Removal of Gaseous Pollutants

Table D identifies pollutant removal mechanisms (sinks) which affect various gaseous air pollutants.

As discussed previously, gaseous pollutants such as sulfur and nitrogen oxides undergo chemical reactions which produce liquid or solid aerosols. These aerosols can serve as condensation nuclei, resulting in rainout or washout of the pollutants. In addition, many gaseous pollutants are at least slightly soluble in water. These pollutants can diffuse into water droplets formed around condensation nuclei, and thus experience washout in this fashion. Because diffusion occurs in proportion to concentration differences, it is possible for pollutants to diffuse into water droplets in one area, be transported by winds to a different area, and diffuse out of the droplets at the second area. Diffusion can also occur into or out of water bodies such as rivers, lakes and oceans.

Chemical reactions involving gaseous pollutants have been discussed previously. These reactions can transform pollutants into normal constituents of the atmosphere, secondary gaseous pollutants, or secondary aerosol pollutants. In addition to chemical reactions in the atmosphere, reactions can occur as pollutants come in contact with objects at the earth's surface.

A final mechanism for removal of gaseous pollutants involves biological processes. Most living organisms, but especially microorganisms and higher plants, absorb many atmospheric gases. Pollutants in these gases may be stored in living tissue, biochemically decomposed to other substances by normal metabolic processes, or may react chemically or biochemically with living tissues. The results of these reactions and metabolic processes may be either detrimental, beneficial or innocuous to the organisms involved.

It is often assumed that removal processes such as those described above are, over any period of a few years, able to prevent any permanent increase in average global concentrations of most pollutants. For most pollutants, however, monitoring instruments are both insufficiently sensitive and inadequately located to provide reliable evidence regarding long-term, global trends in pollutant concentrations. There is, on the other hand, reliable evidence of a global, long-term trend of increasing carbon dioxide (CO_2) levels, most likely related to increasing combustion of fossil fuels (see Table A). Carbon dioxide, however, is seldom viewed as an air pollutant on a local or regional level. There is also significant evidence that suspended particulate levels are increasing, at least over much of the northern hemisphere. Much of this increase appears to be due to photochemically generated aerosols (Whelpdale and Munn, 1976).

Table D

REMOVAL MECHANISMS FOR GASEOUS POLLUTANTS

Substance	*Sinks*
Sulfur dioxide	Precipitation scavenging: washout, rainout Oxidation in gas and liquid phase to sulfate Soil: microbial degradation, physical and chemical reaction, absorption Vegetation: sorption on surfaces, stomatal intake Oceans, lakes: absorption
Hydrogen sulfide	Oxidation to sulfur dioxide
Ozone	Chemical reaction on vegetation, soil, snow and ocean surfaces
Nitrous oxide	Soil: microbiological destruction Stratosphere: photodissociation Ocean: absorption
Nitric oxide/ nitrogen dioxide	Soil: chemical reaction Vegetation: sorption, stomatal uptake Chemical reaction in gas and liquid phase
Ammonia	Chemical reaction to ammonium in gas and liquid phase Precipitation scavenging: washout, rainout Surface uptake: physical and chemical reaction, absorption
Carbon monoxide	Stratosphere: reaction with hydroxyl radical Soil: microbiological activity
Carbon dioxide	Vegetation: photosynthesis, absorption Oceans: absorption
Methane	Soil: microbiological activity Vegetation: chemical reaction, bacterial action Troposphere and stratosphere: chemical reaction
Hydrocarbons	Chemical reaction to particulates Soil: microbiological activity Vegetation: Absorption, stomatal intake

Source: Whelpdale and Munn, 1976.

Effects of Air Pollutants

The effects of air pollutants can generally be categorized as visibility reduction and light scattering; meteorological effects; damage to materials and structures; physiological effects on living organisms; and psychological effects on people.

Visibility Reduction

Visibility reduction by air pollutants is caused primarily by aerosols, although colored gases or water vapor may be significant in special cases. Reduced visibility can be due to dense accumulations of particulates blocking light transmittance by obstruction, or to scattering of light by lower concentrations of aerosols. Significant visibility reduction due to light scattering is often associated with the condensation of water vapor or other liquids around particulates in the 0.1 to 1.0 micron size range. Visibility reduction per se has two major types of consequences -- transportation-related hazards and aesthetic impacts.

Meteorological Effects

Meteorological effects of air pollutants are experienced on both an areawide or local scale and on a global or continental scale. Local or areawide meteorological effects are due mostly to the emissions of aerosols, heat and water vapor. While heat emissions in themselves are seldom viewed as air pollution, heat added to the atmosphere, especially in urban areas, can affect certain meteorological conditions. Urban areas are enveloped by a mass of air that is generally warmer than the air masses over adjacent rural areas. This temperature difference is most pronounced at night, when maximum temperature differences of 3-10°C (6-21°F) can occur. Mean annual temperature differences between adjacent urban and rural areas are usually 0.5-1.5°C (1-3°F). These temperature differences can have significant effects on the local transport and dilution of air pollutants.

The major meteorological effect of local air pollution involves influences on precipitation phenomena. An increase in local aerosol levels (either primary or secondary aerosols) can significantly increase the frequency of fog occurrences, and will in some cases increase cloud cover and/or precipitation rates. The increased occurrence of haze and fog can also affect local thermal and light intensity regimes. If ambient aerosol levels are often high, significant emissions of water vapor can also lead to increased fog or haze formation. Table E summarizes the meteorological effects of urbanization and its attendant pollutant emissions.

Table E

AVERAGE CHANGES IN CLIMATIC ELEMENTS CAUSED BY URBANIZATION

Element	Comparison with Rural Environment
Contaminants:	
condensation nuclei and particles	10 times more
gaseous admixtures	5 to 25 times more
Cloudiness:	
cover	5 to 10 percent more
fog—winter	100 percent more
fog—summer	30 percent more
Precipitation:	
totals	5 to 10 percent more
days with less than 5 mm	10 percent more
snowfall	5 percent more
Relative humidity:	
winter	2 percent less
summer	8 percent less
Radiation:	
global	15 to 20 percent less
ultraviolet—winter	30 percent less
ultraviolet—summer	5 percent less
sunshine duration	5 to 15 percent less
Temperature:	
annual mean	0.5° to 1.0° C more
winter minima (average)	1° to 2° C more
heating degree days	10 percent less
Wind speed:	
annual mean	20 to 30 percent less
extreme gusts	10 to 20 percent less
calms	5 to 20 percent more

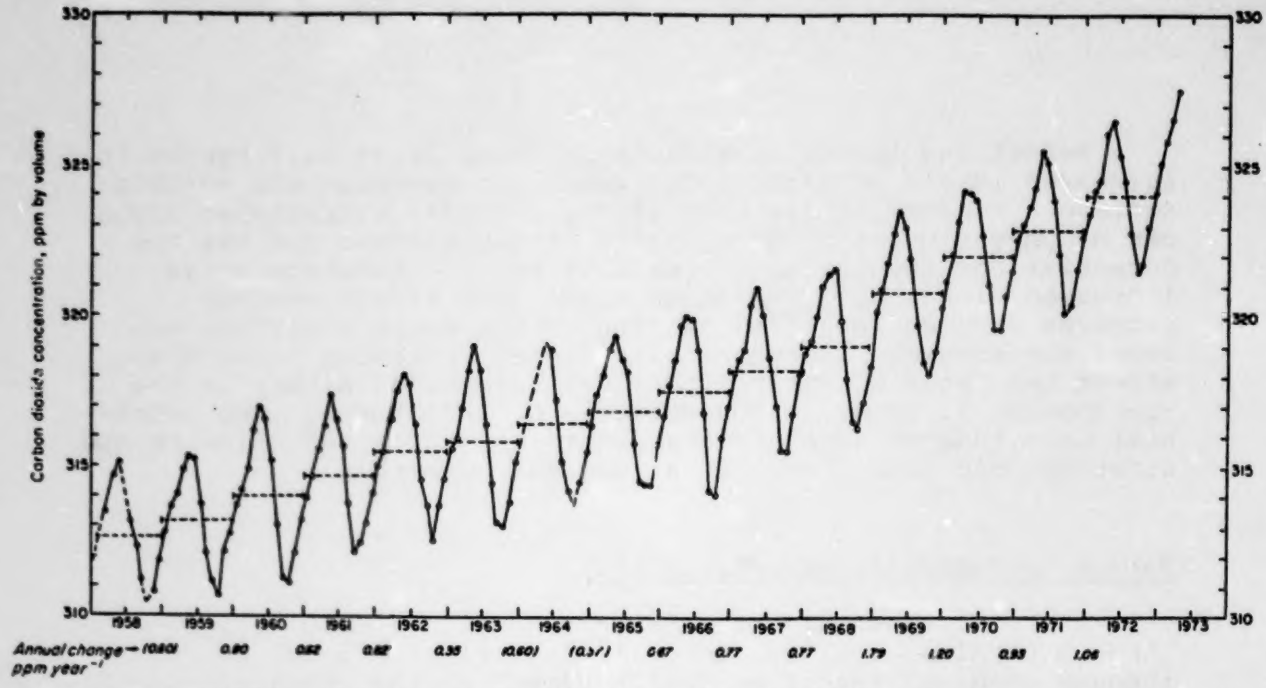
Source: Landsberg, 1970.

On a global and continental scale, three major types of air pollution effects on climate are evident. Global increases in carbon dioxide levels (Figure F) are influencing global temperature regimes. Most of the energy content of sunlight reaching the earth's surface is in the shorter wavelengths of light (toward the ultraviolet portion of the spectrum). Heat produced by absorption of sunlight is radiated as longer wavelengths (toward the infrared portion of the spectrum). Carbon dioxide and water vapor are strong absorbers of infrared radiation; thus, an increase in CO_2 levels in the lower atmosphere traps heat radiated from the earth's surface (the "greenhouse effect").

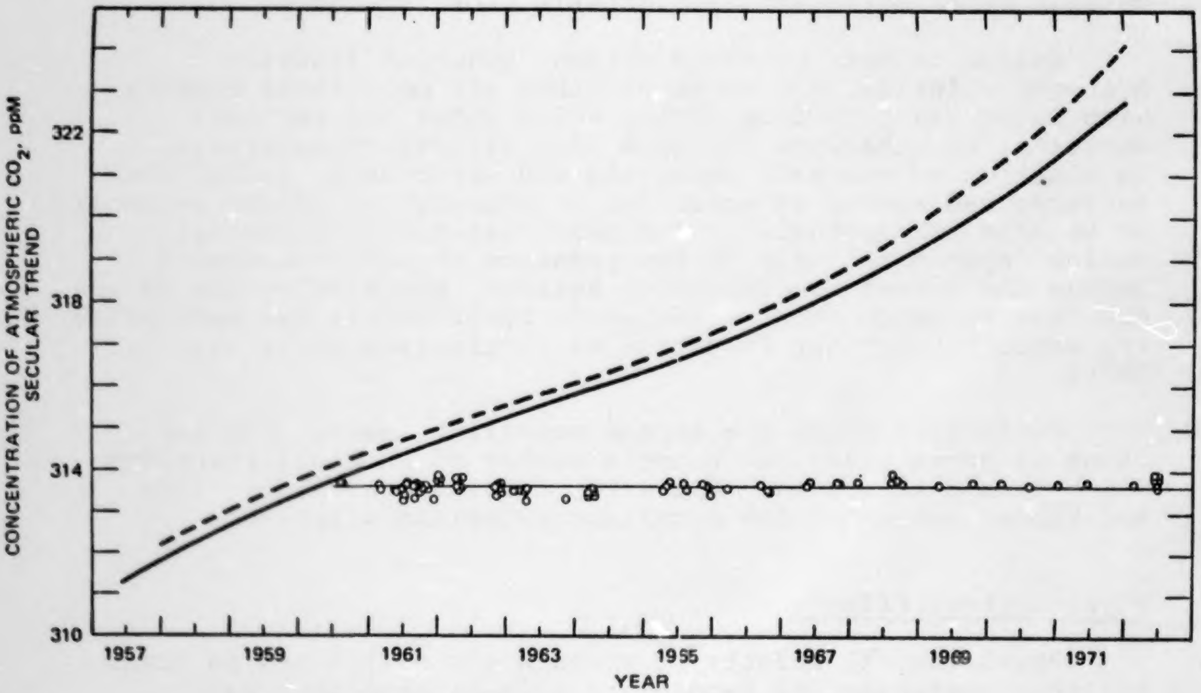
The apparent increase in aerosol concentrations is probably affecting global climatic factors in two major ways. Particulates directly reflect incoming solar radiation back toward space, thus reducing the amount of sunlight reaching the earth's surface. Increases in cloud cover due to condensation of water vapor around aerosols also result in increased reflectance of solar radiation. High altitude cirrus clouds may be especially important in this regard.

Pollutant effects on the stratospheric ozone layer (Figure A) have received significant attention in recent years. This ozone layer shields the earth's surface from high energy, shortwave radiation. Direct injection of combustion products from aircraft flying through the stratosphere could produce reductions in the ozone layer. Both water vapor and oxides of nitrogen would convert stratospheric ozone to molecular oxygen. There is significant uncertainty regarding the potential magnitude of current and future stratospheric ozone reductions from this source.

Most pollutants emitted into the lower atmosphere are unlikely to reach the stratospheric ozone layer due to chemical reactions, precipitation phenomena, and other removal mechanisms operating in the troposphere. Certain compounds which are chemically unreactive under conditions prevailing in the lower atmosphere may, when exposed to intensive ultraviolet radiation in the stratosphere, become involved in chemical reactions in the stratospheric ozone layer. Various chlorofluorcarbons (Freons) are of special concern in this regard, because of the large quantities produced industrially (850,000 tons in 1973), their use as aerosol propellants resulting in direct discharge to the atmosphere, and the lack of significant natural removal from the lower atmosphere (Freons are insoluble in water). Upon exposure to intense ultraviolet light, Freons ($CFCl_3$ and CF_2Cl_2) decompose, releasing chlorine atoms (Cl^-). The chlorine atoms take part in several chemical reactions which convert ozone to molecular oxygen.



Mean monthly carbon dioxide concentrations at Mauna Loa. Horizontal dashed lines indicate average yearly value. Annual changes in parenthesis are based on incomplete record



Comparisons of secular trends of atmospheric CO_2 concentration at Mauna Loa and the South Pole. The dashed curve is for Mauna Loa; the full curve for the South Pole. ○: analyses of a Scripps Institution surveillance reference gas whose mean value is plotted as a straight line.

FIGURE F. GLOBAL CARBON DIOXIDE LEVELS

SOURCES: WHELPDALE & MUNN, 1976
EKDAHL & KEELING, 1973

Reductions in the stratospheric ozone layer will result in increased levels of ultraviolet radiation reaching the earth's surface. Because of its high energy content, ultraviolet light can be physiologically damaging to living tissues and has the potential for causing an increase in genetic mutation rates. Increased ultraviolet radiation might also affect weather patterns through increased heating of the earth's surface and lower atmosphere. Increased ultraviolet radiation could also affect the rates of various chemical reactions, either in the atmosphere, in water, or on surfaces or structures. The potential magnitude of such effects due to any given reduction in the stratospheric ozone layer is at present uncertain.

Damage to Materials and Structures

Air pollutants affect materials and structures either through physical soiling (deposition of particulates) or through chemical reactions (which depend on the chemical composition of both the air pollutant and the material affected). Aerosols are involved in chemical reactions both as primary reactants and as catalysts which speed reactions between other pollutants and materials or structures.

Sulfur oxides, nitrogen oxides, hydrogen fluoride, hydrogen chloride, and numerous other air pollutants combine with water vapor to form strong acids which can corrode, dissolve, or otherwise damage a wide variety of materials. In addition to man-made materials and structures, soils, rock surfaces and bodies of water can be affected by acidic aerosols or by acid precipitation. The potential for acid precipitation depends not only on the presence of acid precursors during the normal precipitation seasons, but also on the extent and rate at which other atmospheric constituents can neutralize the acids through the formation of particulate salts (Winkler, 1976).

Pollutants which are strong oxidizing agents (NO_2 and ozone in particular) can cause a number of chemical reactions which damage materials. Pigments, dyes, synthetic textiles and rubber are among the prominent materials affected.

Physiological Effects

Physiological effects of various air pollutants on human health, vegetation and laboratory animals have been well studied, even though many issues remain unresolved. Most studies have involved exposure to single pollutants, rather than to the types of pollutant mixtures which occur in the atmosphere. The effect of simultaneous exposure to two or more compounds may be qualitatively or quantitatively different from the effects of either compound experienced alone. In addition, the presence of one compound may increase the magnitude of an effect produced by a given amount of a second compound (synergistic effect). Antagonistic effects occur when the presence of one compound inhibits or reduces the effect of a second compound. When two compounds produce similar effects, exposure to a mixture of the two may produce a synergistic, antagonistic, or an additive effect.

Human Health. A variety of different health effects of air pollutants have been recognized. The most frequently observed effect involves irritation of the respiratory system. Long-term exposure to respiratory irritants can greatly increase the chances of chronic respiratory diseases such as chronic bronchitis, pulmonary emphysema and lung cancer. Short-term exposure to high pollutant dosages can cause acute respiratory problems or even death. Pollutants usually identified as contributors to respiratory problems include ozone, nitrogen dioxide, oxides of sulfur, sulfuric acid mists, and aerosols. The combination of particulates and sulfur oxides (probably sulfates and sulfuric acid) is suspected of being the cause of several severe pollution episodes in which deaths were clearly attributable to air pollution. The 1930 air pollution episode in the Meuse Valley of Belgium resulted in 60 deaths and thousands of illnesses. The 1948 Donora, Pennsylvania episode caused 20 deaths and nearly 6,000 illnesses in a town of 14,000. The 1952 London episode produced about 4,000 deaths. A 1962 London episode produced 750 deaths. Air pollution episodes in New York City are considered responsible for causing about 400 deaths in 1963 and 168 in 1966 (American Lung Association, 1974).

Eye irritation is a second widespread effect of air pollution. Ozone, nitrogen dioxide, PAN, and other oxidants are primarily responsible. When absorbed into the blood stream, carbon monoxide, ozone and nitrogen oxides can reduce the oxygen-carrying ability of hemoglobin; carbon monoxide is usually responsible for serious effects in this regard. Respiratory allergies such as asthma can be triggered by a variety of aerosols, sulfur dioxide or ozone. Asthma-producing aerosol pollutants may be either nonviable aerosols (primarily dusts and organic particulates) or viable aerosols (pollen, molds, etc.). It should be noted that viable particulates may be attributable to human actions (agriculture, composting operations, sewage treatment plants) as well as natural sources.

A variety of metallic aerosols and organic compounds are known to be directly toxic to man. Most of these are seldom encountered at concentrations producing acute toxic effects. Some of these compounds, however, may be accumulated and stored in body tissues over extended periods of time. Some organic compounds are also suspected as having carcinogenic (cancer-causing) properties.

There are some indications that chronic exposure to nitrogen dioxide and ozone increases susceptibility to bacterial infection. Bacteria, viruses, fungi, and molds contained in viable aerosols also have the potential for producing infectious diseases if inhaled.

Effects on Animals. The effects of air pollutants on domestic animals, livestock and wildlife can be expected to be similar to the human health effects discussed above. The relative sensitivity of different species will vary considerably, however. While effects of pollutants on laboratory animals, domestic pets and livestock have received some study, effects on wildlife have received very little study.

A number of fish kills in the northeastern United States and in Scandinavia have been attributed to pH changes in lakes and ponds produced by frequent acid rains. In the San Gabriel Mountains of San Bernardino County, older bighorn sheep have been found to be totally or partially blind from what appear to be cataracts (white blotches on the eyeball). This eye damage has been noted only in those parts of the bighorn range subject to high oxidant concentrations (Taylor, et.al., 1973). No study has yet been made to determine whether this condition is in fact caused by air pollution.

Effects on Vegetation. Air pollutants have been reported as affecting vegetation through three types of processes: direct physiological effects (Table F); altered susceptibility to other environmental stresses; and changes in soil properties affecting plants. Direct physiological effects of air pollution may result in visible symptoms of injury to leaves, stems, flowers or roots; hidden symptoms are evidenced as changes in plant metabolism and growth rates.

Air pollutants which have been identified as causing vegetation damage include sulfur dioxide, ozone, peroxyacyl nitrates, nitric oxide, nitrogen dioxide, ethylene, various fluoride compounds, and various particulates. The exact mechanisms by which various air pollutants exert their effects are not fully understood. Most pollutants appear to affect the structure and permeability of cell membranes, at least at high dosages. Other observed effects include destruction of

Table F

EFFECTS OF AIR POLLUTANTS ON VEGETATION

Pollutant	*Sources*	*Plant Symptoms of Injury*	*Injury Threshold*	
			Parts per Million (ppm)	*Periods of Exposure*
Sulfur dioxide (SO_2)	Combustion of coal, fuel oil, and petroleum; oil refineries	Bleached areas on leaves; yellowing of leaves; growth suppression; leaf-fall; reduction in yield	0.3 0.05	8 hours season
Nitrogen dioxide (NO_2)	High-temperature combustion of gasoline, oil, gas, and coal in internal combustion engines and power plants; manufacture of acids	Dead spots between veins and on margins of leaves	2.5 0.5	4 hours season
Hydrogen fluoride (HF)	Phosphate rock processing; aluminum refining; iron smelting; brick and ceramic works; fiber glass manufacturing	Dead tip and margin of leaves; yellowing of leaves; leaf-fall; dwarfing; lower yield	0.0001	5 weeks
Chlorine (Cl_2)	Leaks in chlorine storage tanks; hydrochloric acid mist	Bleaching between veins and dead tip and margin of leaves; defoliation	0.10	2 hours
Ethylene (CH_2)	Automobile and truck exhaust; incomplete combustion of coal, gas, and oil; chemical manufacture	Yellowing of leaves; leaf-fall; failure of flower to open; flower dropping; stimulation of lateral growth	0.05	6 hours
Ozone (O_3)	Photochemical reaction of hydrocarbons and nitrogen oxides from fuel combustion (esp. in automobiles); refuse burning; and evaporation from petroleum products and organic solvents	Flecks and bleached spots on leaves; early leaf-fall; growth suppression	0.03	4 hours
Peroxyacetyl nitrate (PAN)	Same sources as ozone	Discoloration (silvering or bronzing) on undersurface of young leaves -	0.01	6 hours

Source: Detwyler, 1972.

chlorophyll and other pigments; enzyme inactivation; alterations of amino acid composition; altered respiration rates; influence on the control of stomatal openings; and possible mutagenic effects. Dry particulates deposited on plant surfaces appear to affect plants by reducing the level of sunlight reaching plant cells.

Combinations of two or more pollutants often produce synergistic effects. All well defined instances of synergistic effects have involved sulfur dioxide. Combinations of sulfur dioxide and ozone and of sulfur dioxide and nitrogen dioxide almost always yield synergistic or additive effects (Reinert, Heagle and Heck, 1975; Applegate and Durrant, 1969; Tingey, Reinert, Dunning and Heck, 1971, 1973; White, Hill and Bennett, 1974). Combinations of sulfur dioxide and hydrogen fluoride tend to show synergistic effects at low dosages, and either additive or antagonistic effects at higher dosages (Reinert, Heagle and Heck, 1975). Other combinations of air pollutants have received little study.

Exposure to air pollutants may increase the susceptibility of plants to temperature, water, or salinity stresses. On the other hand, some plant pathogens (especially fungi) are frequently more sensitive to certain air pollutants than is their host plant. Sulfur dioxide and certain fluoride compounds are especially toxic to many fungi. Ozone, on the other hand, is often more toxic to the host plant than it is to fungi or bacteria (Treshow, 1975). Bacteria appear to be generally insensitive to air pollutants at concentrations which damage plants (Heagle, 1973). Air pollution damage to vegetation often increases the susceptibility of plants to damage by insect pests (Heagle, 1973; Taylor, et.al., 1973).

Deposition of some particulates and acid precipitation have the potential for altering soil chemistry in ways which adversely affect some plants.

The extent of air pollution damage to vegetation in California is receiving increasing attention. In 1974, fluoride damage was reported from Alameda, Contra Costa, Marin, Monterey and Riverside Counties; sulfur dioxide damage was reported from Contra Costa and Sonoma Counties; peroxyacyl nitrate damage was reported from Butte, Placer, Riverside, San Bernardino, San Diego, Santa Barbara, Sutter, and Ventura Counties; and ozone damage was reported from Alameda, Contra Costa, El Dorado, Orange, Riverside, San Bernardino, San Diego, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, and Ventura Counties, as well as throughout the San Joaquin Valley.

The economic value of air pollution damage to agricultural crops in California has been estimated at $100-132 million per year (Environmental Science and Technology, 1970; Hindawi, 1970) when the economic value of reduced crop yields are considered. Millecan (1976), however, has estimated the value of crop damage in California at $16.1 million for 1970, $19.1 million for 1971, $17.4 million for 1972, $35.2 million for 1973, and $55.1 million for 1974. These values do not completely account for reductions in crop yields, and do not include the value of losses attributable to crop changes forced by air pollution levels. The 1970-74 increase in crop damage primarily reflects increasing crop values, not more extensive damage.

Behavioral and Psychological Effects

The effects of air pollution on people's behavior and attitudes has received little study. Possible effects include increased incidences of psychosomatic illness and personality changes induced by discomfort due to irritating or other health effects of air pollution, noxious odors, etc. On the other hand, increased levels of light-scattering aerosols can produce intense sunsets and sunrises.

APPENDIX A-2

AIR QUALITY MONITORING PROBLEMS

Photochemical Oxidants

Several methods of monitoring ambient levels of ozone and other oxidants have been developed during the last two decades. Instruments based on potassium oxide (KI), ultraviolet photometry and chemoliminescence have been accepted as the preferred methods, with the KI method being the most widely used. The KI instrument consists of pumps and meters for sampling air and metering reagent, a contact column for absorging oxidants in the KI reagent, a calorimeter for measuring iodine released from the reagent, and a strip chart recorder to record oxidant concentration. The instrument is normally calibrated against a known ozone mixture and bubblers containing KI reagent.

The Los Angeles Air Pollution Control District (LAAPCD), San Diego Air Pollution Control District, U. S. Environmental Protection Agency (EPA), and California Air Resources Board (ARB) have all used slightly different procedures for calibrating their KI instruments. Except for the LAAPCD and the San Diego APCD, local air pollution control districts in California have used the ARB calibration procedures. Until recently, these different calibration procedures were assumed to yield comparable results. Comparison tests conducted in 1973 and 1974 revealed that the EPA and ARB procedures (using 1 and per percent neutral buffered KI reagent, respectively) produced oxidant readings which were about 30 percent higher than those given by the LAAPCD.

In August 1974, the ARB appointed a special Oxidant Measurement Committee to review the situation and recommend appropriate action. Tests conducted by this committee confirmed the differences among the EPA, ARB and LAAPCD calibration procedures and also produced evidence that all three procedures were sensitive to changes in relative humidity. The committee recommended that a new calibration procedure be adopted utilizing an ultraviolet photometry method. The new calibration procedure, adopted by the ARB on May 15, 1975, produces an oxidant reading 22 percent lower than that given by the former ARB method, 15 percent lower than the San Diego APCD method, and 4 percent higher than that given by the LAAPCD method. Based on these data, the California Air Resources Board has adopted the following correction factors to be applied to pre-June 1975 data: LAAPCD data - 1.0; San Diego APCD data - 0.85; ARB stations and all other APCD data - 0.8. EPA has also accepted these values as correction factors.

As a result of the instrument calibration problems described above, the AIR Quality Advisory Committee to the California Department of Health undertook a review of the basis for the air pollution emergency episode criteria levels for oxidant. As a result of this review, the ARB lowered the "warning" and "emergency" episode criteria from 40 and 60 pphm to 35 and 50 pphm, respectively. Neither the ARB nor EPA has initiated a similar review of the basis for the existing state and federal oxidant standards.

Lead Particulates

The California Air quality standard for lead (1.5 $\mu g/m^3$ as a 30-day average) is based largely on studies utilizing millipore filters for sampling, direct acid extraction (wet ashing method) for sample preparation, and the dithizone method for determining lead content. Use of fiberglass filters for sample collection or atomic absorption spectroscopy for lead content determination has been shown to produce equivalent results.

Prior to 1975, many local air pollution control districts used a cellulose rather than a fiberglass filter paper (because older types of fiberglass filter paper were contaminated with various heavy metals). In addition, some agencies used a high temperature, dry ashing method rather than the wet ashing method to separate the lead from the filter paper.

Recent comparison studies have shown that use of collulose filters and the wet ashing method produces results which are about 50 percent below those produced by the approved analytical method. Use of cellulose filters and dry ashing produces results about 65 percent below those of the approved method. Beginning in 1975, all local air pollution control districts will be using approved analytical methods. The ARB has established correction factors of 1.3 and 2.92 for converting results of the cellulose filter-wet ashing method and cellulose filter-dry ashing method, respectively, to values consistent with the approved analytical methods. Lead analyses of particulate samples from Salinas, Hollister and Watsonville have been performed using approved methodologies and thus require no correction (Malone, pers. comm.).

APPENDIX A-3

AVERAGE DAILY AIR POLLUTANT EMISSIONS, 1971-74

03-27-72/73

AVERAGE EMISSIONS OF AIR POLLUTA
MONTEREY, SANTA CRUZ COUNTIES - 1971
Tons Per Day

MICROFILMED

EMISSION SOURCES	ORGANIC COMPOUNDS			PARTICULATE MATTER			OXIDES OF NITROGEN			SULFUR DIOXIDE			CARBON MONOXIDE		
	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total
PETROLEUM															
Production	3.4	-	3.4	1.0	-	1.0	4.4	-	4.4	15.1	-	15.1	-	-	-
Marketing	3.0	1.0	4.0	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	6.4	1.0	7.4	1.0	-	1.0	4.4	-	4.4	15.1	-	15.1	-	-	-
ORGANIC SOLVENTS															
Surface Coating	2.5	1.2	3.7	0.1	-	0.1	-	-	-	-	-	-	-	-	-
Dry Cleaning	0.9	0.5	1.4	-	-	-	-	-	-	-	-	-	-	-	-
Degreasing	3.2	1.5	4.7	-	-	-	-	-	-	-	-	-	-	-	-
Other	1.5	0.5	2.0	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	8.1	3.7	11.8	0.1	-	0.1	-	-	-	-	-	-	-	-	-
METALLURGICAL															
Metallurgical	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MINERAL															
Asphalt Batching	-	-	-	0.1	0.1	0.2	-	-	-	-	-	-	-	-	-
Cement	-	-	-	-	2.0	2.0	-	-	-	-	-	-	-	-	-
Dolomite and Magnesia	-	-	-	5.4	-	5.4	-	-	-	-	-	-	-	-	-
Concrete Batching	-	-	-	0.1	-	0.1	-	-	-	-	-	-	-	-	-
Other	-	-	-	0.2	0.1	0.3	-	-	-	-	-	-	-	-	-
SUBTOTAL	-	-	-	5.8	2.2	8.0	-	-	-	-	-	-	-	-	-
INCINERATION															
Open Burning Dumps	0.1	-	0.1	-	-	-	-	-	-	-	-	-	0.2	0.1	0.3
Backyard Burning	5.4	3.3	8.7	2.2	1.3	3.5	1.5	0.9	2.4	-	-	-	11.7	7.0	18.7
Incinerators	-	-	-	-	-	-	-	-	-	-	-	-	0.7	0.3	1.0
SUBTOTAL	5.5	3.3	8.8	2.2	1.3	3.5	1.5	0.9	2.4	-	-	-	12.6	7.4	20.0
COMBUSTION OF FUELS															
Natural Gas															
Steam Power Plants	1.6	-	1.6	1.8	-	1.8	13.9	-	13.9	0.1	-	0.1	-	-	-
Other Industrial	0.1	-	0.1	0.3	0.1	0.4	3.0	1.0	4.0	-	-	-	-	-	-
Domestic & Commercial	-	-	-	0.3	0.1	0.4	1.6	0.8	2.4	-	-	-	-	-	-
Fuel Oil															
Steam Power Plants	-	-	-	0.1	-	0.1	2.3	-	2.3	1.7	-	1.7	-	-	-
Other	-	-	-	-	-	-	0.1	-	0.1	0.1	0.1	0.2	-	-	-
SUBTOTAL	1.7	-	1.7	2.5	0.2	2.7	20.9	1.8	22.7	1.9	0.1	2.0	-	-	-
AGRICULTURE															
Debris Burning	1.0	0.4	1.4	0.7	0.3	1.0	0.1	-	0.1	-	-	-	2.4	0.9	3.3
Orchard Heaters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Product Processing	-	-	-	3.0	0.1	3.1	-	-	-	-	-	-	-	-	-
Pesticides	13.7	0.5	14.2	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	14.7	0.9	15.6	3.7	0.4	4.1	0.1	-	0.1	-	-	-	2.4	0.9	3.3
LUMBERING & WOOD PRODUCTS															
Lumbering & Wood Products	-	0.3	0.3	0.1	0.4	0.5	-	-	-	-	-	-	-	1.6	1.6
TOTAL STATIONARY SOURCES	36.4	9.2	45.6	15.4	4.5	19.9	26.9	2.7	29.6	17.0	0.1	17.1	15.0	9.9	24.9
MOTOR VEHICLES															
Gasoline Powered															
Exhaust	34.1	21.1	55.2	1.9	1.2	3.1	22.8	14.1	36.9	1.1	0.7	1.8	260.0	169.0	429.0
Blow by	3.0	1.9	4.9	-	-	-	-	-	-	-	-	-	-	-	-
Evaporation	13.3	8.3	21.6	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Powered	1.2	0.7	1.9	0.4	0.2	0.6	5.2	3.2	8.4	0.4	0.2	0.6	5.0	3.1	8.1
SUBTOTAL	51.6	32.0	83.6	2.3	1.4	3.7	28.0	17.3	45.3	1.5	0.9	2.4	265.0	172.1	437.1
AIRCRAFT															
Jet Driven	0.1	-	0.1	0.1	-	0.1	0.1	-	0.1	-	-	-	0.1	-	0.1
Piston Driven	0.6	0.1	0.7	0.2	-	0.2	0.6	-	0.6	-	-	-	12.0	0.8	12.8
SUBTOTAL	0.7	0.1	0.8	0.3	-	0.3	0.7	-	0.7	-	-	-	12.1	0.8	12.9
SHIPS AND RAILROADS															
Ships and Railroads	0.5	0.3	0.8	0.2	0.1	0.3	0.6	0.4	1.0	0.4	0.2	0.6	0.6	-	0.6
TOTAL MOBILE SOURCES	52.8	32.4	85.2	2.8	1.5	4.3	29.3	17.7	47.0	1.9	1.1	3.0	277.7	172.9	450.6
GRAND TOTAL	89.2	41.6	130.8	18.2	6.0	24.2	56.2	20.4	76.6	18.9	1.2	20.1	292.7	182.8	475.5
Percent from Mobile Sources	59	78	65	15	25	18	52	87	61	10	92	15	95	95	95

1/72

NOTE: Organic compound emissions from petroleum production at San Ardo not included.

Source: Monterey-Santa Cruz County Unified Air Pollution Control District, 1972.

APR 4 1973

03-27-73/74

AVERAGE EMISSIONS OF AIR POLLUTANTS
MONTEREY, SANTA CRUZ COUNTIES - 1972

Tons Per Day

EMISSION SOURCES	ORGANIC COMPOUNDS			PARTICULATE MATTER			OXIDES OF NITROGEN			SULFUR DIOXIDE			CARBON MONOXIDE		
	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total
PETROLEUM															
Production	3.4	-	3.4	1.7	-	1.7	5.8	-	5.8	26.0	-	26.0	-	-	-
Marketing	3.0	1.0	4.0	-	-	-		-		-	-	-	-	-	-
SUBTOTAL	6.4	1.0	7.4	1.7	-	1.7	5.8	-	5.8	26.0	-	26.0	-	-	-
ORGANIC SOLVENTS															
Surface Coating	2.5	1.2	3.7	0.1	-	0.1	-	-	-	-	-	-	-	-	-
Dry Cleaning	0.9	0.5	1.4	-	-	-	-	-	-	-	-	-	-	-	-
Degreasing	3.2	1.5	4.7	-	-	-	-	-	-	-	-	-	-	-	-
Other	1.5	0.5	2.0	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	8.1	3.7	11.8	0.1	-	0.1	-	-	-	-	-	-	-	-	-
METALLURGICAL															
Metallurgical	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MINERAL															
Asphalt Batching	-	-	-	0.1	0.1	0.2	-	-	-	-	-	-	-	-	-
Cement	-	-	-	-	1.5	1.5	-	-	-	-	-	-	-	-	-
Dolomite and Magnesia	-	-	-	2.6	-	2.6	-	-	-	-	-	-	-	-	-
Concrete Batching	-	-	-	0.1		0.1	-	-	-	-	-	-	-	-	-
Other	-	-	-	0.4	0.4	0.8	-	-	-	-	-	-	-	-	-
SUBTOTAL	-	-	-	3.2	2.0	5.2	-	-	-	-	-	-	-	-	-
INCINERATION															
Open Burning Dumps	0.1	-	0.1	-	-	-	-	-	-	-	-	-	0.2	0.1	0.3
Backyard Burning	5.4	3.3	8.7	2.2	1.3	3.5	1.5	0.9	2.4	-	-	-	11.7	7.0	18.7
Incinerators	-	-	-	-	-	-	-	-	-	-	-	-	0.7	0.3	1.0
SUBTOTAL	5.5	3.3	8.8	2.2	1.3	3.5	1.5	0.9	2.4	-	-	-	12.6	7.4	20.0
COMBUSTION OF FUELS															
Natural Gas															
Steam Power Plants	1.6	-	1.6	1.8	-	1.8	16.0	-	16.0	0.1	-	0.1	10.0	-	10.0
Other Industrial	0.1	-	0.1	0.3	0.1	0.4	6.0	1.0	7.0	-	-	-	10.0	-	10.0
Domestic & Commercial	-	-	-	0.3	0.1	0.4	2.1	0.8	2.9	-	-	-	-	-	-
Fuel Oil															
Steam Power Plants	0.1	-	0.1	0.5	-	0.5	5.1	-	5.1	3.6	-	3.6	-	-	-
Other		-			-		0.1	0.1	0.2	0.1	0.1	0.2	-	-	-
SUBTOTAL	1.8	-	1.8	2.9	0.2	3.1	29.3	1.9	31.2	3.8	0.1	3.9	20.0	-	20.0
AGRICULTURE															
Debris Burning	1.0	0.4	1.4	0.7	0.3	1.0	0.1	-	0.1	-	-	-	2.4	0.9	3.3
Orchard Heaters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Product Processing	-	-	-	1.7	0.1	1.8	-	-	-	--	-	-	-	-	-
Pesticides	13.7	0.5	14.2		-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	14.7	0.9	15.6	2.4	0.4	2.8	0.1	-	0.1	-	-	-	2.4	0.9	3.3
LUMBERING & WOOD PRODUCTS															
Lumbering & Wood Products	-	0.1	0.1	-	0.2	0.2	-	-	-	-	-	-	-	0.5	0.5
TOTAL STATIONARY SOURCES	36.5	9.0	45.5	12.5	4.1	16.6	36.7	2.8	39.5	29.8	0.1	29.9	35.0	8.8	43.8
MOTOR VEHICLES															
Gasoline Powered															
Light Duty	29.8	13.7	48.5	1.3	0.8	2.1	17.8	9.3	27.1	0.7	0.4	1.1	170.0	106.0	276.0
Heavy Duty	22.8	15.6	38.4	0.9	0.6	1.5	8.5	5.3	13.8	0.5	0.3	0.8	99.0	62.0	161.0
SUBTOTAL	52.6	34.3	86.9	2.2	1.4	3.6	26.3	14.6	40.9	1.2	0.7	1.9	269.0	168.0	437.0
Diesel Powered															
On-Highway	0.4	0.3	0.7	0.1	0.1	0.2	3.7	2.3	6.0	0.2	0.2	0.4	2.3	1.4	3.7
Off-Highway	0.1	0.1	0.2	-	-	-	0.7	0.5	1.2	-	-	-	0.5	0.3	0.8
SUBTOTAL	0.5	0.4	0.9	0.1	0.1	0.2	4.4	2.8	7.2	0.2	0.2	0.4	2.8	1.7	4.5
TOTAL MOTOR VEHICLES	53.1	34.7	87.8	2.3	1.5	3.8	30.7	17.4	48.1	1.4	0.9	2.3	271.8	169.7	441.5
AIRCRAFT															
Jet Powered	0.1	-	0.1	0.1	-	0.1	0.1	-	0.1	-	-	-	0.1	-	0.1
Piston Engine	0.6	0.1	0.7	0.2	-	0.2	0.6	--	0.6	-	-	-	12.0	0.8	12.8
SUBTOTAL	0.7	0.1	0.8	0.3	-	0.3	0.7	-	0.7	-	-	-	12.1	0.8	12.9
RAILROADS	0.5	0.3	0.8	0.2	0.1	0.3	0.6	0.4	1.0	0.4	0.2	0.6	0.6	-	0.6
TOTAL MOBILE SOURCES	54.3	35.1	89.4	2.8	1.6	4.4	32.0	17.8	49.8	1.8	1.1	2.9	284.5	170.5	455.0
GRAND TOTAL	90.8	44.1	134.9	15.3	5.7	21.0	68.7	20.6	89.3	31.6	1.2	32.8	319.5	179.3	498.8
PERCENT															
Stationary Sources	40	20	34	82	72	79	53	14	44	94	8	91	11	90	9
Mobile Sources	60	80	66	18	28	21	47	86	56	6	92	9	89	10	91

NOTE: Organic compound emissions from petroleum production at San Ardo not included.

Source: Monterey-Santa Cruz County Unified Air Pollution Control District, 1973.

AVERAGE EMISSIONS OF AIR POLLUTANTS
MONTEREY, SANTA CRUZ COUNTIES - 1973
Tons Per Day

EMISSION SOURCES	ORGANIC COMPOUNDS			PARTICULATE MATTER			OXIDES OF NITROGEN			SULFUR DIOXIDE			CARBON MONOXIDE		
	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total	Monterey	Santa Cruz	Total
PETROLEUM															
Production	0.3	-	0.3	2.4	-	2.4	8.6	-	8.6	33.9	-	33.9	0.5	-	0.5
Marketing	3.2	1.4	4.6	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	3.5	1.4	4.9	2.4	-	2.4	8.6	-	8.6	33.9	-	33.9	0.5	-	0.5
ORGANIC SOLVENTS															
Surface Coating	2.6	1.4	4.0	0.1	-	0.1	-	-	-	-	-	-	-	-	-
Dry Cleaning	0.9	0.5	1.4	-	-	-	-	-	-	-	-	-	-	-	-
Degreasing	1.8	1.0	2.8	-	-	-	-	-	-	-	-	-	-	-	-
Other	7.9	0.5	8.4	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	13.2	3.4	16.6	0.1	-	0.1	-	-	-	-	-	-	-	-	-
METALLURGICAL															
Metallurgical	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MINERAL															
Asphalt Batching	-	-	-	0.1	0.1	0.2	-	-	-	-	-	-	-	-	-
Cement	-	-	-	-	1.5	1.5	-	-	-	-	-	-	-	-	-
Dolomite and Magnesia	-	-	-	2.0	-	2.0	-	-	-	1.7	-	1.7	-	-	-
Concrete Batching	-	-	-	0.1	-	0.1	-	-	-	-	-	-	-	-	-
Other	-	-	-	0.2	0.2	0.4	-	-	-	-	-	-	-	-	-
SUBTOTAL	-	-	-	2.4	1.8	4.2	-	-	-	1.7	-	1.7	-	-	-
INCINERATION															
Open Burning Dumps	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Backyard Burning	6.5	3.5	10.0	0.6	0.4	1.0	-	-	-	-	-	-	14.3	7.7	22.0
Incinerators	-	-	-	-	-	-	-	-	-	-	-	-	0.7	0.3	1.0
SUBTOTAL	6.5	3.5	10.0	0.6	0.4	1.0	-	-	-	-	-	-	15.0	8.0	23.0
COMBUSTION OF FUELS															
Natural Gas															
Steam Power Plants	0.1	-	0.1	1.3	-	1.3	18.0	-	18.0	0.1	-	0.1	8.4	-	8.4
Other Industrial	0.1	-	0.1	0.5	0.1	0.6	9.8	0.3	10.1	-	-	-	10.6	0.1	10.7
Domestic & Commercial	0.1	0.1	0.2	0.3	0.1	0.4	1.5	0.7	2.2	-	-	-	0.3	0.2	0.5
Fuel Oil															
Steam Power Plants	0.3	-	0.3	1.2	-	1.2	6.5	-	6.5	9.6	-	9.6	0.5	-	0.5
Other	-	-	-	-	-	-	-	-	-	-	0.1	0.1	-	-	-
SUBTOTAL	0.6	0.1	0.7	3.3	0.2	3.5	35.8	1.0	36.8	9.7	0.1	9.8	19.8	0.3	20.1
AGRICULTURE															
Debris Burning	1.0	0.4	1.4	0.7	0.3	1.0	0.1	-	0.1	-	-	-	2.4	0.9	3.3
Orchard Heaters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Product Processing	-	-	-	1.1	0.1	1.2	0.8		-	-	-	-	0.1	-	0.1
Pesticides	10.2	1.0	11.2	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	11.2	1.4	12.6	1.8	0.4	2.2	0.9	-	0.9	-	-	-	2.5	0.9	3.4
LUMBERING & WOOD PRODUCTS															
Lumbering & Wood Products	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL STATIONARY SOURCES	35.0	9.8	44.8	10.6	2.8	13.4	45.3	1.0	46.3	45.3	0.1	45.4	37.8	9.2	47.0
MOTOR VEHICLES															
Light Duty Vehicle	23.7	15.5	39.2	1.5	0.8	2.3	20.6	13.5	34.1	0.9	0.6	1.5	175.0	116.0	291.0
Heavy Duty Gasoline	7.6	5.1	12.7	0.3	0.2	0.5	3.6	2.3	5.9	0.1	0.1	0.2	46.4	30.4	76.8
Heavy Duty Diesel	0.8	0.5	1.3	0.3	0.2	0.5	3.6	2.3	5.9	0.3	0.2	0.5	3.4	2.2	5.6
Motorcycle	0.7	0.4	1.1	-	-	-	-	-	-	-	-	-	2.8	1.8	4.6
Evaporation	5.5	3.6	9.1	-	-	-	-	-	-	-	-	-	-	-	-
Crankcase	0.2	0.1	0.3	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	38.4	25.2	63.6	2.1	1.2	3.3	27.8	18.1	45.9	1.3	0.9	2.2	227.6	150.4	376.0
JET AIRCRAFT	0.2	-	0.2	0.2	-	0.2	0.2	-	0.2	-	-	-	0.2	-	0.2
PISTON AIRCRAFT	0.5	0.2	0.7	-	-	-	0.9	-	0.9	-	-	-	18.0	-	18.0
RAILROADS	0.8	-	0.8	0.2	-	0.2	2.9	-	2.9	0.4	-	0.4	1.0	-	1.0
SHIPS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OTHER OFF ROAD VEHICLES	2.8	1.0	3.8	0.4	1.0	1.4	4.5	1.6	6.1	0.7	2.0	2.7	28.7	19.6	48.3
TOTAL MOBILE SOURCES	42.7	26.4	69.1	2.9	2.2	5.1	36.3	19.7	56.0	2.4	2.9	5.3	275.5	170.0	445.5
GRAND TOTAL	77.7	36.2	113.9	13.5	5.0	18.5	81.6	20.7	102.3	47.7	3.0	50.7	313.3	179.2	492.5
PERCENT															
Stationary Sources	45.0	27.0	39.3	78.5	56.0	72.4	55.5	4.8	45.3	95.0	3.3	90.0	12.0	5.1	9.5
Mobile Sources	55.0	73.0	60.7	21.5	44.0	27.6	44.5	95.2	54.7	5.0	96.7	10.0	88.0	94.9	90.5

NOTE: Organic compound emissions from petroleum production at San Ardo not included.
Source: Monterey-Santa Cruz County Unified Air Pollution Control District, 1974.

AVERAGE EMISSIONS OF AIR POLLUTANTS

MONTEREY, SANTA CRUZ AND SAN BENITO COUNTIES 1974

Tons Per Day

EMISSION SOURCES	ORGANIC COMPOUNDS				PARTICULATE MATTER				OXIDES OF NITROGEN				SULFUR DIOXIDE				CARBON MONOXIDE			
	Monterey	Santa Cruz	San Benito	Total	Monterey	Santa Cruz	San Benito	Total	Monterey	Santa Cruz	San Benito	Total	Monterey	Santa Cruz	San Benito	Total	Monterey	Santa Cruz	San Benito	Total
PETROLEUM																				
Production	118.1	-	-	118.1	3.0	-	-	3.0	10.5	-	-	10.5	34.8	-	-	34.8	0.5	-	-	0.5
Marketing	3.2	1.4	0.4	5.0	-	-	-	-	10.5	-	-	10.5	-	-	-	-	-	-	-	-
SUBTOTAL	121.3	1.4	0.4	123.1	3.0	-	-	3.0	10.5	-	-	10.5	34.8	-	-	34.8	0.5	-	-	0.5
ORGANIC SOLVENTS																				
Surface Coating	2.6	1.4	0.2	4.2	0.1	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Dry Cleaning	0.9	0.5	0.1	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Degreasing	1.8	1.0	0.1	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	3.1	0.5	0.2	3.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	8.4	3.4	0.6	12.4	0.1	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
METALLURGICAL																				
Metallurgical	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MINERAL																				
Asphalt Batching	-	-	-	-	0.1	0.1	0.2	0.4	-	-	-	-	-	-	-	-	-	-	-	-
Cement	-	-	-	-	-	1.5	-	1.5	-	-	-	-	-	-	-	-	-	-	-	-
Dolomite & Magnesia	-	-	-	-	1.9	-	0.1	2.0	-	-	-	-	1.0	-	-	1.0	-	-	-	-
Concrete Batching	-	-	-	-	0.1	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	0.2	0.2	0.1	0.5	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	-	-	-	-	2.3	1.8	0.4	4.5	-	-	-	-	1.0	-	-	1.0	-	-	-	-
INCINERATION																				
Open Burning Dumps	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Backyard Burning	3.8	2.0	0.3	6.1	0.3	0.2	-	0.5	-	-	-	-	-	-	-	-	8.3	4.5	0.6	13.4
Incinerators	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	0.3	-	1.0
SUBTOTAL	3.8	2.0	0.3	6.1	0.3	0.2	-	0.5	-	-	-	-	-	-	-	-	9.0	4.8	0.6	14.4
COMBUSTION OF FUELS																				
Natural Gas																				
Steam Power Plants	0.1	-	-	0.1	0.7	-	-	0.7	9.5	-	-	9.5	0.1	-	-	0.1	4.4	-	-	4.4
Other Industrial	0.1	-	-	0.1	0.5	0.1	-	0.6	9.8	0.3	-	10.1	-	-	-	-	10.6	0.1	-	10.7
Domestic & Commercial	0.1	0.1	-	0.2	0.3	0.1	-	0.4	1.5	0.7	0.1	2.3	-	-	-	-	0.3	0.2	-	0.5
Fuel Oil																				
Steam Power Plants	0.4	-	-	0.4	1.4	-	-	1.4	7.9	-	-	7.9	11.6	-	-	11.6	0.6	-	-	0.6
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1	-	-	-	-
SUBTOTAL	0.7	0.1	-	0.8	2.9	0.2	-	3.1	28.7	1.0	0.1	29.8	11.7	0.1	-	11.8	15.9	0.3	-	16.2
AGRICULTURAL																				
Debris Burning	1.0	0.4	0.1	1.5	0.7	0.3	0.1	1.1	0.1	-	-	0.1	-	-	-	-	2.4	0.9	0.2	3.5
Product Processing	-	-	-	-	1.1	0.1	0.1	1.3	0.8	-	-	0.8	-	-	-	-	0.1	-	-	0.1
Pesticides	3.3	0.3	0.3	3.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	4.3	0.7	0.4	5.4	1.8	0.4	0.2	2.4	0.9	-	-	0.9	-	-	-	-	2.5	0.9	0.2	3.6
LUMBERING & WOOD PRODUCTS																				
Lumbering & Wood Products	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL STATIONARY SOURCES	138.5	7.6	1.7	147.8	10.4	2.6	0.6	13.6	40.1	1.0	0.1	41.2	47.5	0.1	-	47.6	27.9	6.0	0.8	34.7
MOTOR VEHICLES																				
Light Duty Vehicle	17.5	11.3	1.3	30.1	1.5	1.0	0.1	2.6	16.4	10.7	1.2	28.3	0.4	0.3	-	0.7	169.2	109.8	12.2	291.2
Heavy Duty Gasoline	7.6	5.1	0.9	13.6	0.3	0.2		0.5	3.6	2.3	0.4	6.3	0.1	0.1	-	0.2	46.4	30.4	5.7	82.5
Heavy Duty Diesel	0.8	0.5	0.1	1.4	0.3	0.2	-	0.5	3.6	2.3	0.4	6.3	0.3	0.2	-	0.5	3.4	2.2	0.4	6.0
Motorcycle	0.7	0.4	-	1.1	-	-	-	-	-	-	-	-	-	-	-	-	2.8	1.8	0.2	4.8
Evaporation	8.7	5.6	0.6	14.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crankcase	0.2	0.1	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTAL	35.5	23.0	2.9	61.4	2.1	1.4	0.1	3.6	23.6	15.3	2.0	40.9	0.8	0.6	-	1.4	221.8	144.2	18.5	384.5
JET AIRCRAFT	0.2	-	-	0.2	0.2	-	-	0.2	0.2	-	-	0.2	-		-	-	0.2	-	-	0.2
PISTON AIRCRAFT	0.5	0.2	-	0.7	-	-	-	-	0.9	-	-	0.9		-	-	-	18.0	-	-	18.0
RAILROADS	0.8	-	-	0.8	0.2	-	-	0.2	2.9	-		2.9	0.4	-	-	0.4	1.0	-	-	1.0
SHIPS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OTHER OFF ROAD VEHICLES	2.8	1.0	0.8	4.6	0.4	1.0	-	1.4	4.5	1.6	1.0	7.1	0.7	2.0	-	2.7	28.7	19.6	8.6	56.9
TOTAL MOBILE SOURCES	39.8	24.2	3.7	67.7	2.9	2.4	0.1	5.4	32.1	16.9	3.0	52.0	1.9	2.6	-	4.5	269.7	163.8	27.1	460.6
GRAND TOTAL	178.3	31.8	5.4	215.5	13.3	5.0	0.7	19.0	72.2	17.9	3.1	93.2	49.4	2.7	-	52.1	297.6	169.8	27.9	495.3
PERCENT																				
Stationary Sources	77.7	24.6	31.5	68.7	78.2	52.0	85.7	71.6	55.5	5.6	3.3	44.7	96.1	3.7	-	91.2	9.7	3.9	3.2	7.4
Mobile Sources	22.3	75.4	68.5	31.3	21.8	48.0	14.3	28.4	44.5	94.4	96.7	55.3	3.9	96.3	-	8.8	90.3	96.1	96.8	92.6

Source: Monterey Bay Unified Air Pollution Control District, 1975.

AVERAGE EMISSIONS OF POLLUTANTS- 1973
NORTH CENTRAL COAST AIR BASIN

AUGUST 2, 1976

TONS PER DAY

1 OF 2

STATIONARY SOURCES	ROG	TOG	PART.	NOX	SO2	CO
PETROLEUM						
PRODUCTION	57.2	107				
REFINING						
MARKETING	5.0	5.2				
SUBTOTAL	62.3	112				
ORGANIC SOLVENT USERS						
SURFACE COATING	3.8	4.2	0.1			
DRY CLEANING		1.5				
DEGREASING	0.3	2.9				
OTHER	6.1	8.4				
SUBTOTAL	10.2	17.0	0.1			
CHEMICAL						
METALLURGICAL			0.2		0.6	
MINERAL			13.4		1.7	
FOOD AND AG PROCESSING			2.6			
PESTICIDES	3.0	3.0				
WOOD PROCESSING						
COMBUSTION OF FUELS						
POWER PLANTS	0.2	0.4	2.5	24.5	9.7	8.9
OTHER INDUSTRIAL	0.2	0.6	3.2	20.6	34.1	11.1
DOMESTIC AND COMMERCIAL	0.2	0.5	0.5	2.4		0.5
ORCHARD HEATERS	5.0	5.1	1.8		0.3	
SUBTOTAL	5.6	6.6	8.0	47.5	44.1	20.5
WASTE BURNING						
AGRICULTURAL DEBRIS	1.0	2.0	1.0			2.6
FOREST MANAGEMENT						
RANGE IMPROVEMENT	0.5	0.9	0.4			1.4
DUMPS						
CONICAL BURNERS						
INCINERATORS						0.7
OTHER	5.3	10.2	1.2			21.5
SUBTOTAL	6.8	13.1	2.6			26.2
MISCELLANEOUS AREA SOURCES						
WILD FIRES	0.3	0.6	0.4			2.0
STRUCTURAL FIRES	0.6	1.2	0.8			3.8
FARMING OPERATIONS			14.9			
CONSTR. AND DEMOL.			0.9			
UNPAVED ROADS			3.8			
UTILITY EQUIP:MOWERS,ETC	0.6	0.7				5.4
SUBTOTAL	1.6	2.5	20.8			11.2
TOTAL,STATIONARY	89.4	154	47.7	47.5	46.4	57.9

AVERAGE EMISSIONS OF POLLUTANTS- 1973
NORTH CENTRAL COAST AIR BASIN

AUGUST 2, 1976 TONS PER DAY 2 OF 2

MOBILE SOURCES	ROG	TOG	PART.	NOX	SO2	CO
MOTOR VEHICLES-ON ROAD						
LIGHT-DUTY VEHICLE EXH	19.4	21.9	3.1	25.5	0.7	230
MED & HEAVY-DUTY VEH EXH	5.0	5.6	0.4	3.9	0.1	48.8
HEAVY-DUTY DIESEL EXH	0.7	0.7	0.5	7.2	0.8	5.2
MOTORCYCLE EXH	0.4	0.5				2.4
EVAPORATION	12.8	13.3				
CRANKCASE	1.0	1.1				
SUBTOTAL	39.4	43.1	4.0	36.6	1.6	286
JET AIRCRAFT	0.2	0.2	0.2	0.2		0.2
PISTON AIRCRAFT	0.7	0.8		0.9		19.8
RAILROADS	0.8	0.8	2.0	2.8	0.4	1.0
SHIPS						
OTHER OFF-ROAD VEH	4.2	4.7	1.6	7.8	3.2	61.1
TOTAL MOBILE SOURCES	45.3	49.6	7.8	48.3	5.2	368
TOTAL, ALL SOURCES	135	204	55.5	95.8	51.6	426

AVERAGE EMISSIONS OF POLLUTANTS- 1973
MONTEREY COUNTY
NORTH CENTRAL COAST AIR BASIN

AUGUST 2, 1976 TONS PER DAY 1 OF 2

STATIONARY SOURCES	ROG	TOG	PART.	NOX	SO2	CO
PETROLEUM						
PRODUCTION	57.2	107				
REFINING						
MARKETING	3.2	3.3				
SUBTOTAL	60.4	110				
ORGANIC SOLVENT USERS						
SURFACE COATING	2.4	2.6	0.1			
DRY CLEANING		0.9				
DEGREASING	0.3	1.8				
OTHER	5.8	7.9				
SUBTOTAL	8.4	13.2	0.1			
CHEMICAL						
METALLURGICAL						
MINERAL			2.4		1.7	
FOOD AND AG PROCESSING			1.7			
PESTICIDES	1.2	1.2				
WOOD PROCESSING						
COMBUSTION OF FUELS						
POWER PLANTS	0.2	0.4	2.5	24.5	9.7	8.9
OTHER INDUSTRIAL	0.2	0.5	3.0	18.4	33.9	11.1
DOMESTIC AND COMMERCIAL	0.1	0.3	0.3	1.5		0.3
ORCHARD HEATERS						
SUBTOTAL	0.5	1.2	5.8	44.4	43.6	20.3
WASTE BURNING						
AGRICULTURAL DEBRIS	0.3	0.5	0.2			0.8
FOREST MANAGEMENT						
RANGE IMPROVEMENT	0.4	0.7	0.3			1.1
DUMPS						
CONICAL BURNERS						
INCINERATORS						0.7
OTHER	3.4	6.5	0.6			14.3
SUBTOTAL	4.0	7.7	1.1			16.9
MISCELLANEOUS AREA SOURCES						
WILD FIRES	0.2	0.3	0.2			1.0
STRUCTURAL FIRES	0.4	0.7	0.5			2.3
FARMING OPERATIONS			12.7			
CONSTR. AND DEMOL.			0.2			
UNPAVED ROADS			1.8			
UTILITY EQUIP:MOWERS,ETC	0.4	0.5				3.4
SUBTOTAL	1.0	1.5	15.4			6.7
TOTAL,STATIONARY	75.5	135	26.5	44.4	45.3	43.9

AVERAGE EMISSIONS OF POLLUTANTS- 1973
MONTEREY COUNTY
NORTH CENTRAL COAST AIR BASIN

AUGUST 2, 1976 TONS PER DAY 2 OF 2

MOBILE SOURCES	ROG	TOG	PART.	NOX	SO2	CO
MOTOR VEHICLES-ON ROAD						
LIGHT-DUTY VEHICLE EXH	11.2	12.6	1.8	14.7	0.4	132
MED & HEAVY-DUTY VEH EXH	2.7	3.0	0.2	2.1	0.1	26.4
HEAVY-DUTY DIESEL EXH	0.4	0.4	0.3	3.9	0.4	2.8
MOTORCYCLE EXH	0.3	0.3				1.3
EVAPORATION	7.3	7.6				
CRANKCASE	0.6	0.6				
SUBTOTAL	22.4	24.5	2.3	20.7	0.9	163
JET AIRCRAFT	0.2	0.2	0.2	0.2		0.2
PISTON AIRCRAFT	0.4	0.5		0.9		18.0
RAILROADS	0.8	0.8	2.0	2.8	0.4	1.0
SHIPS						
OTHER OFF-ROAD VEH	2.6	2.9	0.4	4.7	0.8	29.5
TOTAL MOBILE SOURCES	26.4	28.9	4.9	29.3	2.1	211
TOTAL,ALL SOURCES	102	164	31.4	73.7	47.4	255

Source: California Air Resources Board, 1976c.

APPENDIX A-4

AMBIENT AIR QUALITY DATA

AMBIENT AIR QUALITY DATA: OXIDANTS
(parts per hundred million, by volume)

Station	Year	Annual Mean Hourly Concentration	Mean of Daily Maximum Concentration	Mean of Monthly Maximum Concentration	Maximum Hourly Concentration Measured
Carmel-Valley	1973	—	—	7.3	12
	1974	3.2	4.5	7.7	13
Gonzales-High School	1970	2.3	4.3	8.1	11
	1971	2.4	4.5	8.1	15
	1972	2.6	4.8	8.7	15
	1973	3.0	4.6	9.5	16
	1974	2.4	4.3	7.6	12
Hollister	1973	—	5.0	10.4	13
	1974	—	5.4	10.4	14
Monterey	1970	2.4	3.9	6.8	10
	1971	2.3	3.7	6.9	17
	1972	2.4	3.7	6.7	11
	1973	2.9	4.0	8.8	14
	1974	2.6	4.4	7.2	14
Salinas-Alisal	1970	2.4	3.9	7.2	11
	1971	2.5	4.1	7.0	10
	1972	2.5	4.2	6.9	9
	1973	2.8	4.1	9.0	15
	1974	2.7	4.5	8.0	12
Santa Cruz	1970	1.7	3.2	5.7	9
	1971	1.7	3.4	6.9	18
	1972	1.9	3.5	7.0	10
	1973	2.0	3.6	7.8	12
	1974	1.9	4.0	6.8	12
Watsonville-Trailer	1972	2.4	4.7	8.7	12
	1973	—	—	6.3	7

NOTES:

Carmel station began operating October 1973, but reported no data during July and August 1974.

Gonzales station reported no data during February 1971.

Hollister station operated May through December 1973 and August through December 1974.

Monterey station reported no data during January 1973

Salinas station reported no data during January and February 1971.

Watsonville station operated July 1972 through April 1973

Values listed have not been corrected for recent changes in analytical methods (see Appendix A-2).

AMBIENT AIR QUALITY DATA: CARBON MONOXIDE (CO)
(parts per million, by volume)

Station	Year	Annual Mean Hourly Concentration	Mean of Daily Maximum Concentration	Mean of Monthly Maximum Concentration	Maximum Hourly Concentration Measured
Monterey	1970	1.6	3.6	9.6	17
	1971	1.5	3.5	8.0	13
	1972	1.5	3.3	7.9	12
	1973	1.6	3.0	8.3	13
	1974	1.5	3.0	7.8	16
Salinas-Alisal	1974	2.6	3.2	6.5	13
Watsonville-Trailer	1972	1.7	2.7	4.8	6
	1973	—	—	4.7	7

NOTES:

Watsonville station operated from September 1972 through March 1973.

Monterey station reported no data during March, April and most of June and July 1973.

AMBIENT AIR QUALITY DATA: NITROGEN DIOXIDE (NO_2)
(parts per hundred million, by volume)

Station	Year	Annual Mean Hourly Concentration	Mean of Daily Maximum Concentration	Mean of Monthly Maximum Concentration	Maximum Hourly Concentration Measured
Hollister	1973	—	2.1	5.3	8
	1974	—	3.4	8.2	11
Monterey	1970	2.0	3.6	8.0	12
	1971	1.8	3.2	7.9	15
	1972	1.7	2.9	6.4	11
	1973	1.7	2.6	6.8	12
	1974	1.4	2.2	5.2	9
Salinas-Alisal	1970	2.4	4.1	7.6	10
	1971	2.5	4.3	7.8	11
	1972	2.4	4.2	8.8	11
	1973	2.3	3.7	7.7	14
	1974	2.1	3.6	8.3	15
Santa Cruz	1970	1.4	2.4	4.1	6
	1971	1.5	2.6	4.9	9
	1972	1.9	3.6	8.0	14
	1973	1.4	2.1	5.5	9
	1974	1.3	2.3	4.9	8
Watsonville-Trailer	1972	1.6	3.0	7.8	13
	1973	—	—	5.3	6

NOTES:

Hollister station operated May 1973 through January 1974 and August through December 1974.
Monterey station reported no data during January 1971.
Salinas station reported no data during January or February 1971.
Watsonville station operated July 1972 through March 1973.

AMBIENT AIR QUALITY DATA: NITRIC OXIDE (NO)
(parts per hundred million, by volume)

Station	Year	Annual Mean Hourly Concentration	Mean of Daily Maximum Concentration	Mean of Monthly Maximum Concentration	Maximum Hourly Concentration Measured
Hollister	1973	—	0.4	3.6	6
	1974	—	2.0	6.2	10
Monterey	1970	0.8	3.7	15.5	37
	1971	1.1	5.1	18.1	38
	1972	1.2	5.4	18.8	35
	1973	1.6	5.9	21.1	40
	1974	1.1	5.3	19.9	53
Salinas-Alisal	1970	2.2	8.4	27.3	42
	1971	1.7	7.0	19.1	44
	1972	1.3	6.0	21.1	50
	1973	1.5	5.3	18.9	38
	1974	1.0	4.8	20.4	34
Watsonville-Trailer	1972	0.3	1.7	7.2	9
	1973	—	—	3.7	6

NOTES:

Hollister station operated May 1973 through January 1974 and August through December 1974.
Monterey station reported no data during May 1970 and January 1971.
Salinas station reported no data March through May 1970 and January through February 1971.
Watsonville station operated July 1972 through May 1973.

AMBIENT AIR QUALITY DATA: OXIDES OF NITROGEN
(parts per hundred million, by volume)

Station	Year	Annual Mean Hourly Concentration	Mean of Daily Maximum Concentration	Mean of Monthly Maximum Concentration	Maximum Hourly Concentration Measured
Hollister	1973	—	2.6	5.8	8
	1974	—	5.1	10.6	19
Monterey	1970	2.8	6.8	21.9	40
	1971	2.9	7.6	20.8	42
	1972	2.8	7.8	22.8	38
	1973	3.3	7.8	26.2	46
	1974	2.5	7.2	22.9	59
Salinas-Alisal	1970	4.6	11.8	31.9	46
	1971	4.2	10.4	23.4	48
	1972	3.7	9.5	26.1	55
	1973	3.8	8.6	22.9	41
	1974	3.1	8.0	25.0	40
Watsonville-Trailer	1972	1.8	4.1	10.3	14
	1973	—	—	6.3	9

NOTES:

Hollister station operated May 1973 through January 1974 and August through December 1974.
Monterey station reported no data during May 1970 and January 1971.
Salinas station reported no data during March through May 1970 and January through February 1971.
Watsonville station operated July 1972 through March 1973.

AMBIENT AIR QUALITY DATA: HYDROCARBONS
(parts per million, by volume)

Station	Year	Annual Mean Hourly Concentration	Mean of Daily Maximum Concentration	Mean of Monthly Maximum Concentration	Maximum Hourly Concentration Measured
Hollister	1973	—	2.1	4.6	7
Monterey	1970	2.7	3.7	5.5	7
Salinas-Alisal	1970	2.7	3.6	7.5	13
	1971	2.7	3.7	6.2	12
	1972	2.6	3.5	5.9	10
	1973	2.8	2.9	5.8	12
	1974	3.4	4.4	7.5	18
Watsonville-Trailer	1972	2.3	2.8	4.7	6
	1973	—	—	3.5	3

NOTES:

Hollister station operated May through December 1973.
Monterey station operated January through April 1970.
Salinas station operated July through December 1970.
Watsonville station operated July 1972 through February 1973.

SOURCES: California Air Resources Board, 1974e.
California Air Resources Board, 1970-1975.
Monterey-Santa Cruz County Unified Air Pollution Control District, 1974.
Monterey Bay Unified Air Pollution Control District, 1975.

SULFUR COMPOUNDS (TOTAL SULFATION)
(milligrams $SO_3/dm^2/day$ by alkaline plate method)

Station	Year	Annual Average	Daily Average for Peak Month	Daily Average for Lowest Month
Davenport	1972	0.058	0.156	0.003
	1973	0.031	0.082	0.001
	1974	0.025	0.057	0.002
Hollister	1974	0.014	0.039	0.002
Monterey	1972	0.006	0.014	0.001
	1973	0.011	0.066	0.001
	1974	0.009	0.019	0.001
Moss Landing-Dolan Ranch	1972	0.021	0.052	0.003
	1973	0.016	0.035	0.001
	1974	0.017	0.030	0.004
Moss Landing-Fire Station	1972	0.105	0.372	0.007
	1973	0.094	0.286	0.001
	1974	0.067	0.182	0.025
Salinas-Alisal	1972	0.031	0.077	0.010
	1973	0.020	0.035	0.005
	1974	0.020	0.052	0.002
San Ardo-Main Street	1972	0.089	0.251	0.019
	1973	0.100	0.393	0.010
	1974		0.347	0.031
San Ardo-Mobil Oil Co.	1972	0.917	1.885	0.132
	1973	0.790	1.900	0.087
San Ardo-Mobil #102	1974	0.539	1.077	0.194
San Ardo-Mobil #198	1974	0.364	0.904	0.077
San Ardo-Mobil #223	1974	0.321	0.697	0.125
San Ardo-Texaco	1972	0.417	0.816	0.139
	1973	0.371	0.678	0.015
San Ardo-Texaco #209	1974	0.552	1.057	0.239
San Ardo-Texaco #226	1974	1.806	3.484	0.280
San Ardo-Texaco #268	1974	1.603	2.522	0.140
Watsonville-Hospital	1972	0.007	0.019	0.001
Watsonville-PG&E	1973	0.010	0.052	0.001
	1974	0.009	0.016	0.001

NOTES:

Davenport station reported no data for May 1973.
Monterey station reported no data for February, May or July 1972.
Salinas station reported no data for July 1972.
San Ardo-Main Street station began operating in May 1972.
San Ardo-Mobil Oil Co. station reported no data for August 1972.
San Ardo-Mobil #102 and #223 stations began operating in March 1974.
San Ardo-Texaco #209 and #268 stations reported no data for January 1974.
San Ardo-Texaco #226 station reported no data for December 1974.
Watsonville-Hospital station reported no data during January, February or December 1972.

Sources: Monterey-Santa Cruz County Unified Air Pollution Control District, 1973, 1974.
Monterey Bay Unified Air Pollution Control District, 1975.

LEAD PARTICULATES
(micrograms per cubic meter, $\mu g/m^3$)

Station	Year	Annual Mean of Monthly Averages	Highest Monthly Average	Lowest Monthly Average
Hollister	1973	0.20	0.32	0.09
Salinas-Alisal	1973	0.43	0.82	0.22
	1974	0.49	0.97	0.20
Watsonville	1972	0.29	0.43	0.19
	1973	----	0.38	0.17

NOTES:

Values listed above were determined by approved analytical methods (see Appendix A-2).

Hollister station operated during May through December 1973.

Salinas station began operating in July 1973.

Watsonville station operated from July 1972 through May 1973.

Source: California Air Resources Board, 1970-1975.

TOTAL SUSPENDED PARTICULATES
(micrograms per cubic meter, µg/m^3, by Hi-Volume Method)

Station	Year	Annual Geometric Mean	Maximum 24-Hour Value	Percent of 24-Hour Samples Equaling or Exceeding 100/µg/m^3	Percent of 24-Hour Samples Exceeding 150 µg/m^3
Gonzales	1970	61	134	27	0
	1971	75	211	25	8
	1972	58	157	18	4
	1973	49	159	19	3
	1974	41	94	0	0
Hollister	1974	53	97	0	0
King City	1970	53	112	8	0
	1971	61	156	17	4
	1972	63	160	17	4
	1973	51	133	11	0
Monterey	1970	36	85	0	0
	1971	34	88	0	0
	1972	32	60	0	0
	1973	33	90	0	0
	1974	28	57	0	0
Salinas-Alisal	1970	67	141	26	0
	1971	66	207	25	5
	1972	74	255	23	5
	1973	83	563	35	22
	1974	74	156	28	2
Salinas-Natividad Road	1974	55	94	0	0
Santa Cruz	1970	46	131	5	0
	1971	40	73	0	0
	1972	44	78	0	0
	1973	52	103	10	0
	1974	55	111	10	0
Watsonville-Hospital	1972	47	86	0	0
Watsonville-Trailer	1972	59	142	15	0
	1973	--	75	0	0
Watsonville-PG&E	1973	76	192	21	3
	1974	58	115	8	0

Sources: California Air Resources Board, 1974e.
California Air Resources Board, 1970-1975.
Monterey-Santa Cruz County Unified Air Pollution Control District, 1974.
Monterey Bay Unified Air Pollution Control District, 1975.

SUSPENDED PARTICULATES (COEFFICIENT OF HAZE [COH] VALUE BY AISI METHOD)

Station	Year	Annual Mean of 2-Hour COH Values	Mean of Monthly Highest Daily Average COH Values	Mean of Monthly Maximum 2-Hour COH Values	Maximum 2-Hour COH Value Measured
Gonzales	1970	0.26	0.44	0.80	1.2
	1971	0.25	0.35	0.87	1.4
	1972	0.22	0.34	0.71	1.0
	1973	0.15	0.29	0.57	0.9
	1974	0.13	0.22	0.48	0.7
Hollister	1973	----	0.34	0.71	1.2
Monterey	1970	0.25	0.38	0.88	1.4
	1971	0.23	0.31	0.69	1.4
	1972	0.21	0.31	0.70	1.4
	1973	0.13	0.21	0.77	2.4
	1974	0.14	0.21	0.64	1.0
Salinas-Alisal	1970	0.30	0.56	1.17	1.8
	1971	0.31	0.49	1.05	1.6
	1972	0.31	0.51	1.2	2.0
	1973	0.23	0.34	0.92	1.5
	1974	0.13	0.21	0.53	0.8
Salinas-Natividad Road	1970	0.24	0.36	0.69	0.9
	1971	0.24	0.33	0.72	1.5
	1972	0.21	0.29	0.65	1.2
Santa Cruz	1970	0.24	0.35	1.15	2.4
	1971	0.23	0.30	0.61	1.4
	1972	0.22	0.30	0.98	2.0
	1973	0.22	0.31	0.68	1.2
	1974	0.12	0.22	0.53	1.1
Watsonville-Hospital	1972	0.27	0.47	2.21	5.0
Watsonville-Trailer	1972	0.21	0.46	1.18	1.9
	1973	----	----	0.63	0.9
Watsonville-PG&E	1973	0.20	0.29	0.63	1.1
	1974	0.19	0.33	0.79	1.7

NOTES:

Gonzales station reported no data during May 1970.
Hollister station operated July through December 1973.
Monterey station began operating in July 1970.
Salinas-Alisal station reported no data during January and February 1970.
Salinas-Natividad Road station reported no data during March through May 1970 and December 1972.
Santa Cruz station reported no data during January and February 1970.
Watsonville-Hospital station operated March through November 1972.
Watsonville-Trailer station operated August 1972 through March 1973.
Watsonville-PG&E station began operating in February 1973.

COH values have been classified in a Soiling Index as follows:

COH Units	Range of Soiling
0.0 - 0.9	Light soiling
1.0 - 1.9	Moderate soiling
2.0 - 2.9	Heavy soiling
3.0 - 3.9	Very heavy soiling
4.0 +	Extremely heavy soiling

Sources: California Air Resources Board, 1974e.
California Air Resources Board, 1970-1975.
Monterey-Santa Cruz County Unified Air Pollution Control District, 1974.
Monterey Bay Unified Air Pollution Control District, 1975.

APPENDIX A-5

FEBRUARY 1976 PROJECTION OF AIR QUALITY IN MONTEREY COUNTY

Emissions Forecasts

Estimates of the quantities of various air pollutants which will be generated in the future are essential for any estimate of future ambient air quality. Table I presents estimates of average daily air pollutant emissions by source category for 1985 and 1995. These emission projections were prepared with minor modifications of the procedures described in California Air Resources Board, 1974c.

Emissions calculations for most stationary sources involved multiplying emissions for a base year (from Appendix A-3) by an appropriate growth factor. Growth factors for use with 1972 base data are presented in Exhibit A. In several cases, a year other than 1972 was selected as being the most appropriate base year, and growth factors from Exhibit A were modified accordingly. The selection of an appropriate base year was made by comparing the emission inventories for 1972-74 and related discussions of inventory techniques and source control programs in the annual reports of the local Air Pollution Control District. Emissions from power plants and mobile sources were estimated by a variety of techniques as described in more detail below.

Reactive hydrocarbon emissions were estimated for major source categories using 1972 statewide proportionality factors as presented in California Air Resources Board, 1974a. Exhibit B illustrates these factors and applies them to the 1971-74 emission inventory data.

Total hydrocarbon emissions from the San Ardo oil fields were calculated separately from other petroleum production sources. The steam injection wells at this field were recently recognized as a major source of hydrocarbon emissions. Recently implemented control procedures are expected to be at least 98 percent effective (Abercrombie, pers. comm.).

Future emissions from the Moss Landing power plant were the most difficult source to project. Power generation at this facility will fluctuate according to the availability of power from hydroelectric and nuclear generating plants. Fuel oil is expected to become the exclusive fuel at this facility by 1980 (Exhibit C). In the absence of other figures, 1985 power generation at Moss Landing was assumed to be 8 million megawatt-hours; 1995 generation was assumed to be 11 million megawatt-hours. These values were combined with emission factors presented in Exhibit D to produce estimated power plant emissions.

Projected motor vehicle emissions for hydrocarbons, nitrogen oxides and carbon monoxide are based on weighted composite emission factors presented in Exhibit E and on adjusted projections of average daily vehicle miles of travel (VMT). The Monterey County Transportation Study (MCTS) projected 1995 VMT levels based on a county population somewhat higher than the California Department of Finance D-100 projections. Since emissions from several source categories were calculated as proportional to the D-100 population projections, the 1995 VMT projections from MCTS were adjusted to a D-100 population base. An average daily VMT value for 1985 was estimated as proportional to the relative population increase (1973 to 1985 period as compared to the 1973-1995 period). VMT values used were: 1973 VMT -- 5,068,697; extrapolated 1985 VMT -- 7,191,960; adjusted 1995 VMT -- 9,156,798. Emissions of sulfur oxides and particulates were assumed to be proportional to changes in VMT, with 1973 used as a base year.

Projected aircraft emissions utilized weighted composite emission factors (Exhibit F) and a proportionality equation given in California Air Resources Board, 1974c.

$$E_{fy} = E_{by} \times \frac{P_{fy}}{P_{by}} \times \frac{EF_{fy}}{EF_{by}}$$

E Emissions (tons/day)
P Population (D-100 projections)
EF Emission Factor (Exhibit F)
by Base year (1973, with 1975 emission factors assumed applicable to 1973)
fy Future year

Table I

PROJECTED EMISSIONS OF AIR POLLUTANTS IN MONTEREY COUNTY BY SOURCE CATEGORY

Source	Base Year	Growth Factor	Projected 1985 Emissions, Tons Per Day					
			Hydrocarbons		Nitrogen Oxides	Sulfur Oxides	Carbon Monoxide	Particulate
			Total	Reactive				
Petroleum Industries								
Production	1972	1.52	8.65	2.43	15.23	50.46	0.73	4.35
Marketing	1972	1.29	3.87	1.09				
Solvent Users								
Surface Coatings	1972	2.03	5.08	0.85				0.20
Dry Cleaning	1972	1.29	1.16	0.20				
Degreasing	1973	2.03	3.65	0.62				
Other	1974	1.26	3.91	0.66				
Minerals Industries	1974	1.12				1.12		2.58
Food Processing	1974	1.45			1.16	1.16	0.11	1.60
Pesticides	1974	1.09	3.60	2.86				
Combustion of Fuels								
Power Plants	NA	NA	2.24	0.74	31.92	58.88	0.81	3.42
Other Industrial	1972	2.03	0.20	0.03	12.38	0.20	20.30	0.61
Domestic and Commercial	1974	1.29	0.13	0.02	1.94		0.39	0.39
Waste Burning								
Agricultural Debris	1972	1.15	1.15	0.14	0.12		2.76	0.81
Incinerators	1972	1.29					0.90	
Other	1972	1.29			0.13	0.13		
TOTAL STATIONARY			33.64	9.64	62.88	111.95	26.00	13.96
Motor Vehicles	1973	NA	11.81	8.86	12.60	1.84	141.19	2.98
Trains, Off-Road Vehicles	1973	1.28	4.61	3.45	9.47	1.41	38.01	0.77
Aircraft	1973	NA	0.62	0.37	1.20		14.85	0.20
TOTAL MOBILE			17.04	12.68	23.27	3.25	194.05	3.95
TOTAL EMISSIONS			50.68	22.32	86.15	115.20	220.05	17.91

Table I (Continued)

Source	Base Year	Growth Factor	Projected 1995 Emissions, Tons Per Day					
			Hydrocarbons		Nitrogen Oxides	Sulfur Oxides	Carbon Monoxide	Particulate
			Total	Reactive				
Petroleum Industries								
Production	1972	1.92	10.93	3.07	19.43	64.38	0.93	5.55
Marketing	1972	1.55	4.65	1.31				
Solvent Users								
Surface Coatings	1972	3.30	8.25	1.39				0.33
Dry Cleaning	1972	1.55	1.40	0.23				
Degreasing	1973	3.30	5.94	1.00				
Other	1974	1.52	4.71	0.79				
Minerals Industries	1974	1.50				1.50		3.45
Food Processing	1974	2.04			1.63	1.63	0.20	2.24
Pesticides	1974	1.18	3.89	3.10				
Combustion of Fuels								
Power Plants	NA	NA	3.08	1.02	43.89	80.96	1.11	4.71
Other Industrial	1972	3.30	0.33	0.06	20.13	0.33	33.0	0.99
Domestic and Commercial	1974	1.55	0.16	0.03	2.33		0.47	0.47
Waste Burning								
Agricultural Debris	1972	1.25	1.25	0.15	0.13		3.0	0.88
Incinerators	1972	1.55					1.09	
Other	1972	1.55			0.16	0.16		
TOTAL STATIONARY			44.59	12.15	87.70	148.96	39.80	18.62
Motor Vehicles	1973	NA	9.08	6.81	12.11	2.35	159.38	3.79
Trains, Off-Road Vehicles	1973	1.54	5.54	4.15	11.39	1.69	45.70	0.92
Aircraft	1973	NA	0.41	0.24	1.19		7.70	0.18
TOTAL MOBILE			15.03	11.20	24.69	4.04	212.78	4.89
TOTAL EMISSIONS			59.62	23.35	112.39	153.0	252.58	23.51

NOTE: See accompanying text for discussion of methodology.

Sources: Derived from data in Monterey-San Cruz County Unified Air Pollution Control District, 1973, 1974; Monterey Bay Unified Air Pollution Control District, 1975; California Air Resources Board, 1973b, 1974a, 1974c and 1974d; California Department of Transportation, 1975b; Gruen Gruen + Associates, 1975a; O. N. Ford, 1975; K. H. Huston, 1975; and J. Abercrombie, pers. comm.

EXHIBIT A

GROWTH FACTORS FOR ESTIMATING FUTURE YEAR STATIONARY SOURCE EMISSIONS

MONTEREY COUNTY - Salinas, Monterey Standard Metropolitan Statistical Area

EMISSION SOURCES-GROWTH INDICATOR CATEGORY (Total Earnings Index)	GROWTH FACTORS			
	1972	1975	1985	1995
PETROLEUM				
Production - (Mining-crude petroleum & natural gas)	100	110	152	192
Refining - (Manufacturing-petroleum refinining)	100	100	100	100
Marketing - (Population[2])	100	106	129	155
ORGANIC SOLVENT USERS				
Surface Coating - (Manufacturing-composite index)	100	122	203	330
Dry Cleaning - (Population[2])	100	106	129	155
Degreasing - (Manufacturing-composite index)	100	122	203	330
Other - (Population[2])	100	106	129	155
CHEMICAL - (Manufacturing-chemical and allied products)	100	124	201	327
METALLURGICAL - (Manufacturing-primary metals)	100	-	-	-
MINERAL - (Mining metal or non-metallic, except fuels)	100	98	116	155
FOOD AND AGRICULTURAL PROCESSING - (Manufacturing food&kindred products)	100	112	160	224
PESTICIDES - (Agriculture-composite index)	100	109	115	125
WOOD PROCESSING - (Manufacturing-lumber products and furniture)	100	134	179	247
COMBUSTION OF FUELS				
Power Plants[3]	100	-	-	-
Other Industrial - (Manufacturing-composite index)	100	122	203	330
Domestic and Commercial - (Population[2])	100	106	129	155
Orchard Heaters - (Agriculture-composite index)	100	109	115	125
WASTE BURNING				
Agricultural Debris - (Agriculture-composite index)	100	109	115	125
Forest Management - (Forest and Fisheries)	100	119	178	238
Range Improvement - (Agriculture-composite index)	100	109	115	125
Dumps[4]	100	-	-	-
Conical Burners - (Manufacturing-lumber products and furniture)	100	134	179	247
Incinerators - (Population[2])	100	106	129	155
Other - (Population[2])	100	106	129	155
MISCELLANEOUS AREA SOURCES				
Wild Fires - (Population[2])	100	106	129	155
Structural Fires - (Population[2])	100	106	129	155
Farming Operations - (Agriculture-composite index)	100	109	115	125
Construction and Demolition - (Contract Construction)	100	132	221	360
Unpaved Roads - (Population[2])	100	106	129	155
Other - (Population[2])	100	106	129	155

[1] Based on total earnings projections from "Population and Economic Activity in the United States and Standard Metropolitan Statistical Areas, Historical and Projected 1950-2020," Bureau of Economic Analysis, United States Department of Commerce. July, 1972. PB 216 207.

[2] Population growth factors based on projections of California Department of Finance, D-100 series. January 10, 1974.

[3] Special study - Please refer to section on Fossil Fuel Electric Generating Plants.

[4] Enforcement activities by ARB should eliminate this source by 1975; future emissions are assumed negligible.

Source: California Air Resources Board, 1974c.

EXHIBIT B

REACTIVE HYDROCARBON EMISSIONS IN MONTEREY COUNTY
(tons per day)

Source	Reactive Hydrocarbons as % of Total Hydrocarbons	1971	1972	1973	1974
Petroleum Industries	29.125	34.93	34.93	34.12	34.12
Organic Solvent Users	16.842	1.36	1.36	2.22	1.41
Mineral Industries	1.515	0	0	0	0
Food Processing	0.714	0	0	0	0
Pesticides	79.487	10.89	10.89	8.11	2.62
Combustion of Fuels	16.923	0.288	0.305	0.102	0.118
Waste Burning	12.222	0.794	0.794	0.917	0.587
TOTAL STATIONARY		48.262	48.279	45.469	38.855
Motor Vehicles	75.00	38.7	39.75	28.8	26.63
Jet aircraft	46.154	0.046	0.046	0.092	0.092
Piston Aircraft	74.545	0.447	0.447	0.373	0.373
Trains	74.286	0.371	0.371	0.594	0.594
Off-Highway Vehicles	75.000		0.075	2.10	2.10
TOTAL MOBILE		39.564	40.689	31.959	29.789
TOTAL EMISSIONS		87.826	88.968	77.428	68.644

NOTE: 1971-1973 values for petroleum industries adjusted to reflect previously undetected hydrocarbon emissions at the San Ardo oil fields (117.8 tons per day, total hydrocarbons).

Sources: California Air Resources Board, 1974a; Monterey-Santa Cruz County Unified Air Pollution Control District, 1972, 1973, 1974; Monterey Bay Unified Air Pollution Control District, 1975.

PACIFIC GAS AND ELECTRIC COMPANY

COPY

EXHIBIT C

October 6, 1975

Mr. Mark Said
Gruen Gruen & Associates
564 Howard Street
San Francisco, California 94105

Dear Mr. Said:

This is in response to your letter of September 15, 1975, regarding our Moss Landing Power Plant.

Attached is a sheet showing historic and current generation as well as fuel consumption. It is difficult to predict future generation due to the weather variables. In 1974 and 1975, considerable power was available from the Pacific Northwest. The higher than average precipitation in these years also made higher than average power available from our own hydroelectric plants. This accounts for the decline in total generation over 1972, a dry year. Also, in 1975 power was purchased from SMUD's Rancho Seco Nuclear Plant.

Natural gas is burned as a boiler fuel when available. We expect gas to be available only 25% of the time in 1976 and 17% of the time in 1977. Supplies will continue to decline until 1979 or 1980 when no gas will be available for power plant boiler fuel.

In mid 1976 Unit 1 of our Diablo Canyon Nuclear Power Plant will start production. This will reduce total generation at Moss Landing approximately 10% over 1975. In mid 1976 Unit 2 will start production. This should cause an approximate 25% reduction over 1975. By 1980 Moss Landing should be back to 1975 production.

The fuels burned at Moss Landing do not exceed .5% sulphur by weight. It is not anticipated that there will be any change in this requirement as long as adequate supplies of low sulphur fuel are available.

I hope this answers your questions; if not, please let me know.

Sincerely,

K. H. Huston
Executive Representative

KHH/bjm
Attach.
cc: Mr. Harold Bissell
Jones & Stokes Associates
455 Capitol Mall, Ste. 835
Sacramento, California 95814

Generation and Fuel Burned, Moss Landing Power Plant

Year	Generation (MW)	Fuel	
		Gas, MCF	Oil, Bbls
Thru Aug 1975	5,449,922.05	28,507,645	3,051,700
1974	6,205,127.85	34,289,735	3,289,914
1973	9,557,681.40	65,088,838	2,708,850
1972	16,815,973.25	84,761,815	992,031
1971	9,052,118.50	79,354,187	528,187
1970	9,161,752.20	75,358,562	30,208

EXHIBIT D

Emission Factors for Emissions from Fossil Fuel Electric Generating Plant in Tons Per Day/Million MWH Per Year[1]

Pollutant	Fuel		
	Natural Gas	Fuel Oil	Coal[2]
Oxides of Nitrogen (NOx)	2.0	3.99	9.59
Particulate Matter	0.114	0.428	1.37
Sulfur Dioxide (SO_2)		14.72(S) where (S) represents sulfur content of fuel in percent by weight	16.44
Total Organic Gases	0.013	0.28	0.1712
Reactive Organic Gases	6% of total organic gas emissions	33% of total organic gas emissions	not known
Carbon Monoxide	Assumed negligible	Assumed negligible	0.57[3]

---

[1] From internal ARB report by Alan Goodley, Engineering Evaluation Unit, April 16, 1974.

[2] Provided by Alan Goodley, Engineering Evaluation Unit, June 25, 1974. Based on New Source Performance Standards promulgated by the Environmental Protection Agency.

[3] Based on data in [7]

Source: California Air Resources Board, 1974c.

EXHIBIT E

COMPOSITE EMISSION FACTORS USED IN CALCULATING MOTOR VEHICLE EMISSIONS IN MONTEREY COUNTY

Vehicle Type	Pollutant	Composite Emission Factors, CVS-2 Test Cycle (grams per mile)					VMT-Based Weighting Factor
		1972	1973	1975	1985	1995	
Light-duty, gasoline powered	Hydrocarbons	8.73	7.33	4.52	0.79	0.38	83.7%
	Carbon Monoxide	53.7	48.2	37.1	5.03	2.86	
	Oxides of Nitrogen	5.64	4.81	3.15	0.68	0.52	
Heavy-duty, gasoline powered	Hydrocarbons	24.26	21.89	17.14	7.44	5.20	10.2%
	Carbon Monoxide	187.8	169.4	132.7	126.3	124.8	
	Oxides of Nitrogen	9.16	9.09	8.95	4.60	3.29	
Heavy-duty, diesel powered	Hydrocarbons	3.53	3.34	2.97	1.04	0.8	5.3%
	Carbon Monoxide	21.21	20.47	19.0	12.7	12.0	
	Oxides of Nitrogen	30.63	30.32	29.7	10.36	8.0	
On-road motor-cycles	Hydrocarbons	10.62	10.62	10.62	1.29	0.66	0.9%
	Carbon Monoxide	34.9	34.9	34.9	4.47	3.4	
	Oxides of Nitrogen	0.16	0.16	0.16	0.58	0.4	
Weighted composite factors	Hydrocarbons	10.06	8.64	5.78	1.49	0.90	
	Carbon Monoxide	64.54	59.02	45.91	17.81	15.79	
	Oxides of Nitrogen	7.29	6.56	5.12	1.59	1.20	

NOTES AND SOURCES:

1975, 1985 and 1995 vehicle emission factors from California Air Resources Board, 1974c.

1972 vehicle emission factors derived from 1972 7-mode emission factors by using ratios derived from 1975 7-mode and CVS-2 emission factors as given in California Air Resources Board, 1973b and 1974c, respectively.

1973 vehicle emission factors derived by linear extrapolation from 1972 and 1975 CVS-2 values.

Weighting factors based on 1972 statewide averages as reported in California Air Resources Board, 1974c.

EXHIBIT F

COMPOSITE EMISSION FACTORS USED IN CALCULATING AIRCRAFT EMISSIONS IN MONTEREY COUNTY

Aircraft Type	Average No. of Engines	% of Total Operations		Resultant Weighting Factor		Aircraft Type	Average No. of Engines	% of Total Operations		Resultant Weighting Factor	
		1975	1995	1975	1995			1975	1995	1975	1995
Mid-Range Jet	2.5	6.61	9.74	0.16525	0.2435	Piston Transport	4	33.62	18.04	1.3448	0.7216
Commercial Turboprop	3	0.25	0.07	0.0075	0.0021	Helicopter	2	2.03	1.62	0.0406	0.0324
Business Jet	3	1.02	1.44	0.0306	0.0432	Military Transport	4	0.10	0.07	0.0040	0.0028
General Aviation Turboprop	2	0.81	0.72	0.0162	0.0144	Military Jet	2	1.02	0.72	0.0204	0.0144
General Aviation Piston	1	54.43	67.48	0.5443	0.6748	Military Piston	2	0.10	0.07	0.0020	0.0014

NOTES: Aircraft types and average number of engines from U. S. Environmental Protection Agency, 1975 . Percent of total operations based on incomplete data shown in Exhibit G.

	Year	Hydrocarbons		Carbon Monoxide	Oxides of Nitrogen	Sulfur Oxides	Particulates
		Total	Reactive				
Weighted composite emission factors (pounds per landing and take-off cycle)	1975	56.19	33.26	419.72	2.44	0.593	0.868
	1985	38.68	22.90	267.60	2.08	0.544	0.682
	1995	21.17	12.53	115.48	1.71	0.495	0.495

NOTES: Derived from weighting factors given above and emission factors given in Exhibit H. 1985 values interpolated.

EXHIBIT G

September 17, 1975

Mr. Harold Bissell
JONES & STOKES ASSOCIATES
455 Capitol Mall, Ste. 835
Sacramento, Ca. 95814

Dear Hal:

Roberta Mundie asked me to research Mike Rushton's questions regarding current and projected aircraft operations in both Monterey County and the study area. Unfortunately, none of the airports, with the possible exception of Monterey Peninsula Airport, break their operations into the desired level of detail. I have asked Mr. O. N. Ford, Manager of Monterey Peninsula Airport, to send you their information on current and projected aircraft operations. Mr. Ford wasn't sure whether or how the information was broken down. None of the other airports have projections of future operations.

In the enclosed table, I am presenting what sketchy information I have been able to gather. The data are based on telephone conversations with representatives of the three airfields listed, and they represent the closest approximations that the individuals cared to make. I have been unable to contact Mr. Peter Defino, Director of the small Carmel Valley Airport. Nevertheless, in a telephone conversation with Ernie Franco of the Monterey County Planning Department, I learned that Carmel Valley Airport currently has approximately 30 operations a month. According to Mr. Franco, only small, general utility planes land at Carmel Valley. Although Mr. Defino apparently would like to expand the operations of the airport, there is strong opposition to this from the surrounding community.

The King City Airport is also a small time operation. Thirty-five planes are stationed at the airport and it is seldom used by anyone else. The planes at King City are used mostly for crop dusting.

Gruen Gruen + Associates
564 Howard Street
San Francisco Ca 94105
(415) 433-7596

The three airfields located in the study area are: Monterey Peninsula Airport, Salinas Airport and the airfield at Fort Ord. King City Airfield and Carmel Valley Airport are located within Monterey County, but outside of the study area.

I am also enclosing Chapter 8 of the 1970 Salinas-Monterey Area Transportation Study. This is a good statement of the air transportation problems and trends in the Monterey-Salinas area, at least as of 1970.

I hope the enclosed information is helpful in preparing the air quality portion of the EIS. If you have any questions, please contact me.

Very truly yours,

Mark Said

Mark Said
Economist

P.S. Here are some historical population figures for the study area.

MS

MS:ps
Enc.

EXHIBIT G (Cont'd)

CURRENT AIRCRAFT OPERATIONS

	Salinas[1]	King City[2]	Fort Ord[3]
Long range jet	0	0	0
Mid range jet	0	0	0
Air carrier turboprop	0	0	0
Business jet	1%	occasional	0
Gen'l. aviation turboprop	1%	0	0
Gen'l. aviation piston	30-33%	most	0
Piston transport	60%	a few	0
Helicopter	3%	0	72-76 (Oct) 191[4]
Military transport		0	0
Military jet }	1-2%		
Military piston	0		6-8%

[1] Based on telephone conversation with Mr. Gus Meiser, Salinas Airport, September 15, 1975.

[2] Based on telephone conversation with Mr. Lee Yarborough, King City Airport, September 15, 1975.

[3] Based on telephone conversation with Mr. Wilson, Public Information Officer at Fort Ord, September 16, 1975.

[4] In October, Fort Ord's function will change as it will become headquarters for the Seventh Division.

MONTEREY PENINSULA AIRPORT DISTRICT

BOARD OF DIRECTORS
TED DUREIN, CHAIRMAN • LOUIS V. SCHMIDT • RICHARD TOURANGEAU • JACK W. FLAHERTY • KEI NAKAMURA
EXECUTIVE STAFF
D. N. FORD, AIRPORT MANAGER • F. R. FULLER, ASSISTANT MANAGER • E. I. DUNNE, SECRETARY • L. L. FENTON, COUNSEL

September 23, 1975

Gruen Gruen & Associates
564 Howard Street
San Francisco, CA 94105

Attention: Mr. Mark Said

Dear Mr. Said:

In reply to your letter of September 16, 1975, the following information is transmitted. Your request for specifics was not detailed so the information has to be general in nature, and in some areas we do not hold the desired data.

*Annual Aircraft Operations:

	Present	Projected (1995)
Long Range Jet	none	none
Mid Range Jet	11,000	27,000
Air Carrier Turboprop	500	none
Business Jet	1,000	3,000
General Aviation Turboprop	500	1,000
General Aviation Piston	70,000	150,000
Piston Transport	100	none
Helicopter	200	500
Military Transport	200	200
Military Jet	100	100
Military Piston	50	none

*An operation by FAA definition is a landing or a takeoff.

Sincerely,

O N Ford.
O. N. Ford
District Manager

ONF:rs

c.c: Mr. Harold Bissell

TELEPHONE (408) 373-3731 POST OFFICE BOX 550 MONTEREY, CALIFORNIA 93940

EXHIBIT H

EMISSION FACTORS PER AIRCRAFT LANDING-TAKEOFF CYCLE
(lb/engine)

Aircraft	Solid particulates		Sulfur oxides		Carbon monoxide		Hydrocarbons		Nitrogen oxides (NO_x as NO_2)	
	1975	1995	1975	1995	1975	1995	1975	1995	1975	1995
Jumbo jet	1.30	1.30	1.82	1.82	46.8	8.4	12.2	1.8	31.4	15.7
Long range jet	1.21	.61[a]	1.56	1.56	47.4	8.5	41.2	6.2	7.9	4.0
Medium range jet	0.41	.21[a]	1.01	1.01	17.0	3.1	4.9	0.74	10.2	5.1
Air carrier turboprop	1.1	1.1	0.40	0.40	6.6	2.6	2.9	0.58	2.5	2.0
Business jet	0.11	0.11	0.37	0.37	15.8	6.3	3.6	0.72	1.6	1.3
General aviation turboprop	0.20	0.20	0.18	0.18	3.1	1.2	1.1	0.22	1.2	1.0
General aviation piston	0.02	0.02	0.014	0.014	12.2	6.1	0.40	0.28	0.047	0.047
Piston transport	0.56	0.56	0.28	0.28	304.0	152.0	40.7	28.5	0.40	0.40
Helicopter	0.25	0.25	0.18	0.18	5.7	5.7	0.52	0.52	0.57	0.57
Military transport	1.1	1.1	0.41	0.41	5.7	5.7	2.7	2.7	2.2	2.2
Military jet	0.31	0.31	0.76	0.76	15.1	15.1	9.93	9.93	3.29	3.29
Military piston	0.28	0.28	0.14	0.14	152.0	152.0	20.4	20.4	0.20	0.20

1975 factors from AP-42, Compilation of Air Pollutant Emission Factors, Environmental Protection Agency, April 1973.

1995 factors are based on 1975 factors and the percentage reductions expected from implementation of the emission standards. [19]

[a] Assumed 50% reduction

Source: California Air Resources Board, 1974c.

Ambient Air Quality Projections

Due to the limitations of available data and air quality projection techniques, future ambient air quality in the study area is most appropriately analyzed at a countywide scale. Table II presents projections of potential future ambient air quality under adverse meteorological conditions similar to those occurring in the base year indicated. These estimates were calculated using countywide D-100 population projections because they most closely represent present population trends in Monterey County. The projection methodology was taken from Introduction to Manual Methods for Estimating Air Quality, prepared by the California Air Resources Board (1974).

As indicated in Table II, oxidant levels should show a significant improvement due to emission controls on new motor vehicles, gradual elimination of older vehicles, and improvements in stationary source emission controls. Nitrogen dioxide levels are expected to increase significantly, while particulate levels are expected to decrease for several years and then increase. Only the particulate levels are expected to exceed federal primary standards. There is insufficient data available to project sulfur dioxide levels.

Table II

PROJECTED AMBIENT AIR QUALITY IN MONTEREY COUNTY

Pollutant	Averaging Time	PROJECTED MAXIMUM VALUE			PROJECTED COUNTYWIDE MEAN OF MONTHLY MAXIMUM VALUES			FEDERAL STANDARDS		CALIFORNIA
		Base Year and Value	1985	1995	Base Year and Value	1985	1995	Primary	Secondary	Standard
Oxidant[1] (ppm)	1 hour	1973: 0.125	0.058	0.059	1973: 0.0675	0.042	0.042	0.08	0.08	0.10
Nitrogen Dioxide[2] (ppm)	1 hour	1974: 0.15	0.178	0.231	1972: 0.076	0.094	0.122	—	—	0.25
Carbon Monoxide (ppm)	1 hour	1974: 16.0	12.09	13.73	1973: 8.3	6.13	6.89	35	35	40
Particulates[3] ($\mu g/m^3$)	AGM 24 hours	1973: 83 1973:563	75.45 497.9	90.69 629.2	— —	— —	— —	75 260	60 150	60 100

NOTES AND SOURCES:

ppm	Parts per million by volume.
$\mu g/m^3$	Micrograms per cubic meter.
AGM	Annual geometric mean.
Formula	$AQ_{fy} = B + (AQ_{by} - B) \times \frac{E_{fy}}{E_{by}}$
AQ	Ambient air quality.
B	Natural background pollutant level.
E	Emissions.
fy	Future year.
by	Base year.

Formula and procedures described in California Air Resources Board, 1974d.

Background pollutant levels from California Air Resources Board, 1974a.

Historical emission levels given in Appendix A-3. Historical ambient air quality levels given in Appendix A-4.

[1] Calculations utilized reactive hydrocarbon emission levels. Values presented represent corrected levels (see Appendix A-2).

[2] Calculations utilized oxides of nitrogen emission levels.

[3] Emission levels corrected for photochemically generated aerosols as in California Air Resources Board, 1974c.

APPENDIX A-6

REACTIVITY CLASSIFICATION OF ORGANIC GAS EMISSIONS BY SOURCE CATEGORY

Source	Percentages by Class of Organic Gas Emissions		
	Class I	Class II	Class III
Petroleum			
Production	46.5	53.5	0.0
Refining	4.1	73.3	22.6
Marketing			
Terminal and Storage	5.7	70.0	24.3
Auto Tank Filling	2.3	67.4	30.3
Organic Solvent Users			
Surface Coating			
Heat Dried	3.7	28.0	68.3
Air Dried	9.2	53.4	37.4
Dry Cleaning			
Petroleum Based	0.0	94.3	5.7
Perchloroethylene	100.0	0.0	0.0
Degreasing			
Perchloroethylene or 1,1,1 - Trichloroethane	100.0	0.0	0.0
Trichloroethylene	0.0	0.0	100.0
Printing			
Rotogravure	6.0	69.0	25.0
Flexigraphic	15.0	10.0	75.0
Rubber, Plastic, Putty and Adhesive Mfg.	18.1	25.4	56.5
Pharmaceutical Mfg.	21.7	6.8	71.5
Misc. Organic Solvent Users	27.2	36.9	35.9
Chemical	0.0	0.0	100.0
Metallurgical	0.0	0.0	100.0
Mineral	66.2	10.3	23.5
Food and Agricultural Processing	0.0	0.0	100.0
Pesticides	0.0	30.0	70.0
Wood Processing	60.0	15.0	25.0
Combustion of Fuels			
Power Plants	2.6	53.1	44.3
Other Industrial	2.6	53.1	44.3
Domestic and Commercial Heaters	2.6	53.1	44.3
Orchard Heaters	2.6	53.1	44.3

Source	Percentages by Class of Organic Gas Emissions		
	Class I	Class II	Class III
Waste Burning			
Agricultural Debris	48.0	18.0	34.0
Forest Management	48.0	18.0	34.0
Range Improvement	48.0	18.0	34.0
Dumps	48.0	18.0	34.0
Conical Burners	48.0	18.0	34.0
Incinerators	48.0	18.0	34.0
Other Waste Burning	48.0	18.0	34.0
Miscellaneous Area Sources			
Wild Fires			
Structural Fires			
Utility Equip: Mowers, etc.	11.3	42.1	46.6
Gasoline Powered Vehicles			
Exhaust	11.3	42.1	46.6
Evaporative	3.5	56.4	40.1
Crankcase	7.2	49.7	43.1
Diesel Powered Vehicles	2.6	53.1	44.3
Aircraft			
Jet	2.0	47.6	50.4
Piston	14.4	41.4	44.2
Locomotives	2.6	53.1	44.3
Ships			
Steam	65.7	10.6	23.7
Diesel	2.6	53.1	44.3

Source: California Air Resources Board, 1976b.

APPENDIX A-7

SUPPORTING DATA FOR FEBRUARY 1977 PROJECTION OF FUTURE AIR QUALITY IN MONTEREY COUNTY

Background

The air quality implications of the proposed project have been examined in detail on three occasions during the preparation of this EIS. The first evaluation, completed in February 1976, has been presented in Appendix A-5. The results of the most recent evaluation are presented in the text of the EIS and in this appendix. The reasons for the repeated evaluation of air quality issues are discussed in the following paragraphs.

Several events in early 1976 necessitated a reanalysis of potential air quality problems in Monterey County. Subsequent to preparation of Appendix A-5, both EPA and ARB released significant revisions to their previous estimates of historical and projected motor vehicle emission rates (U. S. Environmental Protection Agency, 1976; California Air Resources Board, 1976b). ARB also adopted a revised hydrocarbon reactivity classification, resulting in significant revisions to previous estimates of the reactive fraction of hydrocarbon emissions from both stationary and mobile sources. Additionally, ARB revised its estimates of vehicles in use by county and average annual mileage by vehicle type. Revised VMT projections were released for the Monterey County Transportation study (California Department of Transportation, 1976) in April 1976.

Following preparation of Appendix A-5, questions were raised by ARB regarding the extent to which historical emissions of hydrocarbons at the San Ardo oil field may have influenced oxidant levels recorded in the Salinas and Monterey Bay areas. The state and federal oxidant standards were exceeded most frequently and to the greatest extent in 1973. Wind data for days in 1973 which had high oxidant levels are presented in Appendix B (Table B-4). In all but a few cases, winds at Salinas airport were from the northwest. While it is evident from the data in Appendix B that hydrocarbon emissions from the San Ardo oil fields will influence air quality in the Monterey and Salinas areas on a few days each year, most high oxidant days at both Monterey and Salinas (including the days with maximum oxidant levels) appear not to be influenced by the San Ardo emissions. Thus, the emissions and air quality projections in Appendix A-5 required revisions to exclude the current San Ardo emissions from consideration.

At the time Appendix A-5 was prepared, planning for the sizing and staging of the North Monterey County Facilities Plan was based on population projections prepared for the Monterey County Transportation Study (MCTS). Prior to the April 1976 revision, these MCTS projections were slightly higher than the California Department of Finance D-100 series population projections used as a basis for the analysis in Appendix A-5. During 1976, however, the design basis for facilities planning was changed to a composite of local agency population projections substantially exceeding the Department of Finance D-100 projections.

During late October and early November 1976, potential oxidant and nitrogen dioxide levels were reanalyzed on the basis of most of the factors discussed above. This analysis indicated a strong potential for the county continuing to exceed both state and federal oxidant standards through 1995, and the possibility of exceeding state nitrogen dioxide standards from about 1985 on. This reanalysis of the air quality implications was evaluated by EPA, ARB and the SWRCB. On the basis of this review, an additional air quality analysis was undertaken in February 1977.

The February 1977 analysis was originally oriented toward evaluating the air quality implications of a project sized according to the Department of Finance D-100 population projection. During the course of this evaluation, errors in the November 1976 analysis were discovered. The scope of the February 1977 analysis was then expanded to include a reevaluation of the project sized in accordance with the Draft Facilities Plan.

Emissions Forecasts

Base Year Emissions Inventories

Emissions forecasts are usually made by estimating future changes from current or recent levels of air pollutant emissions. Thus, an accurate "base year" emissions inventory is essential. Emissions inventories prepared by the local air pollution control district were used for the analysis presented in Appendix A-5. In August 1976 the ARB released a report providing statewide, air basin and county emissions inventory data for calendar year 1973. This data included revisions to county air pollution control district (APCD) data, especially the data for motor vehicle emissions. These revisions incorporated the new emission factor and hydrocarbon reactivity data mentioned above. Comparison of the ARB emissions inventory with the local APCD inventory for 1973 revealed several significant differences between these sources.

The reasons for these differences were determined through contacts with the ARB Emissions Inventory Unit; a revised 1973 Monterey County emissions inventory was then prepared and used in developing a revised 1974 emissions inventory. Table III, which follows the narrative section of this appendix, explains the modifications which were made to the ARB and APCD data. Briefly, discrepancies involved a failure of the ARB data to fully account for all pesticide and herbicide usage in the county, and the accidental deletion from the ARB data of NO_x emissions from agricultural product processing and agricultural burning. Differences in motor vehicle emissions estimates presented by the APCD and ARB were due primarily to different estimates of historical VMT levels; the APCD data were also based on outdated vehicle emission factor data. To maintain consistency with the emissions forecasts used in this analysis, a separate estimate of motor vehicle emissions based on VMT data from the county transportation study was prepared.

Emissions Projections

The basic steps used in estimating future pollutant emissions levels are identified in Tables III-VIII, which follow this narrative. Future emissions from most source categories are based on "growth factors" normalized to 1974 as a base year. Selection of 1974 as a base year was dictated by improved emissions controls or process changes which resulted in changes from 1973 conditions. Changes in pesticide formulations represented an especially significant factor. Growth factors were based either directly on population growth or on an index of economic activity correlated with population growth.

Emissions from the Moss Landing power plant were based on rather arbitrary projections of possible generation rates. PG&E anticipates a generation level of about 8 million megawatt-hours in 1980 (Exhibit C of Appendix A-5). Moss Landing has a 2,060 megawatt capacity rating. Few power plants operate consistently at much over 60 to 70 percent of their potential capacity (California Energy Resources Conservation and Development Commission, 1976). Recognizing current and anticipated problems in rapidly building major new power plants, it seemed reasonable to anticipate that this facility would be operating at a 60 to 70 percent capacity factor by 1990. Since 582 megawatts of capacity is scheduled for retirement at about 1992 or 1993 (California Energy Resources Conservation Development Commission, 1976), the 1995 power generation level was set at 70 percent of the remaining 1,478 megawatt capacity.

Aircraft emissions were based on emission factors developed in Exhibit F of Appendix A-5, 1974 emission levels and population projection data. No major aircraft emission controls are expected prior to 1981.

Motor vehicle emissions projections presented in Tables VII and VIII are based on VMT data from the County Transportation Study. VMT-weighted, class composite vehicle emission factors for Monterey County are presented in Table V. As discussed in the text of this EIS, an alternative to the MCTS data on VMT levels was also evaluated. These alternative VMT data are based on 1973 vehicle registration data, a Department of Motor Vehicles estimate of vehicle registration growth rate by vehicle type and county, and an estimate of annual vehicle mileage by vehicle type. The data used in this EIS are presented in Table IV.

Evaluation of VMT Estimates

The two available sources of VMT data are discussed below in terms of considerations important for air quality analysis.

MCTS Data

The Monterey County Transportation Study included the development of a computer model for forecasting future travel demands based on future population, land use, and socioeconomic forecasts. No report has yet been prepared to describe all of the assumptions, procedures, and data used in this model. The following discussion is thus based on brief descriptions presented in various MCTS documents, the MCTS traffic analysis zone map, and inferences based on a general knowledge of traffic modeling procedures used elsewhere in California.

The MCTS model has the advantages of covering all of Monterey County with a pattern of traffic analysis zones, which appears to be based largely on census tracts. A full map of the highway network used in the model has not been published in the transportation plan report or the EIR on that plan. However, it appears that most major roads are incorporated into the model network. Local neighborhood street systems are not included, however. No information is presented in the above reports to indicate whether or not correction factors are incorporated into the model to account for travel on such streets or to account for trips made solely within one traffic analysis zone.

Trip generation factors used in the model appear to be based on land use and population characteristics, and on origin-destination surveys conducted during the 1970-1972 period. The accuracy of the trip generation equations derived from these data are, of course, difficult to assess. Trip distribution along alternative routes connecting major origin and destination centers was apparently based on normal "gravity model" procedures. These procedures assign travel demands to the route having the lowest travel time. This distribution of trips did not account for congestion factors, which will develop as traffic approaches roadway capacity. Some manual readjustment of traffic volume assignments was done, however, in those cases where projected travel demand exceeded current or assumed highway capacity.

It is not clear from the transportation plan report or the EIR on the plan whether the VMT projections reflect annual average daily VMT or average weekday VMT conditions. This EIS has assumed the values are annual average daily VMT values. While VMT values for both 1974 and 1995 were produced by the model, results of any calibration or validation checks using actual 1974 traffic count data are not presented in the transportation plan report or its EIR. The VMT forecast from the model is not broken down by vehicle type, nor are the vehicle occupancy assumptions presented.

Thus, the MCTS data suffer from certain deficiencies common to most traffic models: incomplete road system coverage; probable failure to account for travel within analysis zones; lack of disaggregation of data by vehicle type; etc. Evaluation of the accuracy of the model results is also hindered by the lack of any concise technical report explaining the details of model development, validation, underlying assumptions, etc.

ARB-DMV Data

The California Air Resources Board (1976b) has compiled data by county on the numbers of vehicles in use during 1973 (by vehicle type) and the expected annual rate of increase in vehicle registrations. The vehicle registration increase rate is based on the Department of Finance D-100 population projections. Average annual mileage by vehicle type is also provided in the above report. These mileage figures are based on studies in major urban areas of the state. These data can be used to derive estimates of future vehicle numbers and future VMT for any county in the state.

The above procedure has two major strengths with regard to air quality analyses. Estimates can be made for any desired year, and VMT can be segregated by vehicle type.

One weakness of such a procedure centers on the applicability of the average annual mileage values to the Monterey Bay area. More important, however, is the fact that any VMT estimate derived by these procedures relates to total mileage traveled by vehicles registered in Monterey County, not VMT by vehicles traveling in Monterey County. VMT within Monterey County by vehicles registered elsewhere is not included, while VMT for Monterey County vehicles traveling outside the county is included. Thus, use of such VMT estimates implicitly assumes that the above two VMT sources are approximately equal. It is difficult to estimate whether tourist travel in Monterey County balances travel by county residences outside the county. Transport of agricultural produce from the Salinas Valley represents a specific VMT category where such a balance should not be automatically assumed.

Table III

MODIFIED MONTEREY COUNTY EMISSIONS INVENTORIES FOR HYDROCARBONS AND NITROGEN OXIDES (TONS PER DAY, ANNUAL AVERAGE)

Source Category	1973[1]			1974[2]		
	THC	RHC	NO_x	THC	RHC	NO_x
Petroleum Marketing	3.3	3.2	0	3.2	3.1	0
Solvent Users:						
Surface coatings	2.6	2.4	0	2.6	2.4	0
Degreasing	1.8	0.3	0	1.8	0.3	0
Dry cleaning	0.9	0	0	0.9	0	0
Other	7.9	5.8	0	3.1	2.3	0
Food Processing	0	0	0.8	0	0	0.8
Pesticides	10.2	10.2	0	3.3	3.3	0
Fuel Combustion:						
Power plants	0.4	0.2	24.5	0.5	0.5	17.4
Other industry	0.5	0.2	9.8	0.1	0.1	9.8
Domestic and commercial	0.3	0.1	1.5	0.1	0.1	1.5
Waste Burning:						
Agriculture and range	1.2	0.7	0.1	1.0	0.5	0.1
Other	6.5	3.4	0	3.8	2.0	0
Total Stationary Sources	35.6	26.5	36.7	20.4	14.6	29.6
Miscellaneous Area Sources	1.5	1.0	0	1.5	1.0	0
Motor Vehicles - On Road	57.9	52.6	29.7	57.3	52.0	29.5
Trains and Off-Road Vehicles	3.7	3.4	7.5	3.6	3.3	7.4
Aircraft	0.7	0.6	1.1	0.7	0.6	1.1
Total Mobile Sources	62.3	56.6	38.3	61.6	55.9	38.0
TOTAL EMISSIONS	99.4	84.1	75.0	83.5	71.5	67.6
Percent of Emissions From:						
Stationary sources	38.5	31.5	48.9	24.4	20.4	43.8
Miscellaneous area sources	1.5	1.2	0	1.8	1.4	0
Mobile sources	62.7	67.3	51.1	73.8	78.2	56.2

NOTES AND SOURCES:

THC Total hydrocarbons
RHC Reactive hydrocarbons (ARB reactivity Classes II and III)
NO_x Oxides of nitrogen

[1] From California Air Resources Board, 1976c (see Appendix A-3) with the following modifications:
- o All petroleum production emissions omitted to exclude the San Ardo oil fields from consideration in "base year" conditions in air quality projections.
- o THC emissions associated with pesticide use from Monterey-Santa Cruz Air Pollution Control District, 1974 (Appendix A-3); RHC emissions based on ARB reactivity classification (Appendix A-6).
- o NO_x emissions from food processing based on Monterey-Santa Cruz County Air Pollution Control District, 1974.
- o NO_x emissions from fuel combustion by "other industry" corrected through comparison with county APCD data to exclude emissions associated with petroleum production.
- o NO_x emissions from agricultural and range management burning based on Monterey-Santa Cruz County Air Pollution Control District, 1974.
- o Motor vehicle emissions based on adjusted VMT level from the Monterey County Transportation Study (California Department of Transportation, 1976) and VMT-weighted, class-composite vehicle emission factors for Monterey County (see Table IV and Table V, respectively).

[2] From Monterey Bay Unified Air Pollution Control District, 1975 (see Appendix A-3) with the following modifications:
- o For source categories showing no change from 1973 value in the THC emissions, RHC emissions held at 1973 level. RHC emissions for "other" solvent users category based on reactivity factor derived from 1973 data; RHC emissions for remaining source categories based on ARB reactivity classification (Appendix A-6).
- o All petroleum production emissions omitted to exclude San Ardo oil fields from consideration in "base year" conditions in air quality projections.
- o Miscellaneous area source emissions assumed equal to 1973 emissions reported in California Air Resources Board, 1976c.
- o Motor vehicle emissions based on adjusted VMT level extrapolated from Monterey County Transportation Study and VMT-weighted, class-composite vehicle emission factors for Monterey County (see Table IV and Table V, respectively).

Table IV

COMPARISON OF POPULATION/VMT FORECASTS

Parameter	Forecast Basis	1973	1974	1980	1985	1990	1995	% Change 1973-1995
Population	MCTS[1]	251,653					392,040	55.8%
Daily VMT	MCTS[1]	4,900,000					8,736,000	78.3%
Population	D-100[2]	255,400	261,600	299,000	329,800	362,100	396,500	55.2%
Daily VMT	ARB-DMV[3]	3,460,685	3,573,781	4,251,945	4,817,123	5,382,329	5,947,534	71.9%
Population	D-100[2]	255,400	261,600	299,000	329,800	362,100	396,500	55.2%
Daily VMT	Adjusted MCTS[4]	4,972,959	5,142,676	6,166,451	7,009,560	7,893,730	8,835,384	77.7%
Population	County Composite[2]	255,400	261,600	327,879	363,136	404,040	485,339	90.0%
Daily VMT	Adjusted ARB-DMV[5]	3,460,685	3,573,781	4,671,725	5,255,774	5,933,369	7,280,127	110.4%
Population	County Composite[2]	255,400	261,600	327,879	363,136	404,040	485,339	90.0%
Daily VMT	Adjusted MCTS[6]	4,972,959	5,142,676	6,823,015	7,716,869	8,753,888	10,815,023	117.5%

NOTES:

[1] From Monterey County Transportation Study (California Department of Transportation, 1976).

[2] See Table 46 in text of EIS.

[3] Based on California Air Resources Board adjustments of Department of Motor Vehicles' vehicle registration data and projections; derived from data presented in California Air Resources Board, 1976b.

[4] 1973 and 1995 VMT extrapolated on population basis from MCTS data; 1974-1990 VMT calculated as follows (Pop = population):

19-- VMT = (19-- Pop - 1973 Pop) ÷ (1995 Pop - 1973 Pop) X (1995 VMT - 1973 VMT) + 1973 VMT.

[5] 1973 and 1974 values from unadjusted ARB-DMV data (see note 3). 1995 VMT extrapolated on a population basis from ARB-DMV data. 1980-1990 VMT calculated as follows:

19-- VMT = (19-- Pop - 1974 Pop) ÷ (1995 Pop - 1974 Pop) X (1995 VMT - 1974 VMT) + 1974 VMT.

[6] 1973 and 1974 values from D-100 based adjustment of MCTS data (see note 4). 1995 VMT extrapolated on a population basis from unadjusted MCTS data. 1980-1990 VMT calculated by procedure outlines in note 5 above.

Table V

COMPOSITE VEHICLE EMISSION FACTORS FOR MONTEREY COUNTY (GRAMS PER MILE)

Vehicle Type	Parameter	1973	1974	1980	1985	1990	1995
Light-duty autos[1]	THC	7.95	7.62	3.45	1.47	1.12	0.99
	RHC	7.22	6.92	3.18	1.37	1.03	0.91
	NO_x	4.17	3.85	2.25	1.50	1.28	1.28
	% County VMT[3]	74.07%	73.94%	73,29%	72.88%	72.56%	72.30%
Light-duty trucks[1]	THC	10.56	10.13	5.80	2.42	1.77	1.61
	RHC	9.63	9.24	5.35	2.22	1.62	1.47
	NO_x	5.03	4.71	3.96	2.78	2.57	2.46
	% County VMT[3]	11.75%	11.72%	11.62%	11.56%	11.51%	11.47%
Heavy-duty, gasoline-powered vehicles[1]	THC	34.71	32.73	20.3	15.9	12.8	12.0
	RHC	31.30	29.53	18.46	14.56	11.81	11.1
	NO_x	8.9	9.4	11.1	11.7	12.4	12.4
	% County VMT[3]	9.04%	9.14%	9.62%	9.92%	10.16%	10.35%
Heavy-duty, diesel-powered vehicles[1]	THC	5.2	5.2	5.2	5.2	5.2	5.2
	RHC	5.06	5.06	50.6	5.06	5.06	5.06
	NO_x	20.9	20.9	20.3	20.3	20.3	20.3
	% County VMT[3]	4.49%	4.54%	4.78%	4.93%	5.04%	5.14%
Motorcycles[2]	THC	8.82	8.82	7.21	6.78	2.28	2.28
	RHC	7.87	7.87	6.44	6.06	2.07	2.07
	NO_x	0.2	0.2	0.24	0.26	0.38	0.38
	% County VMT[3]	0.66%	0.66%	0.69%	0.71%	0.73%	0.74%
VMT-weighted, class-composite emission factors	THC	10.56	10.11	5.45	3.23	2.60	2.43
	RHC	9.59	9.18	5.01	2.99	2.40	2.25
	NO_x	5.42	5.21	4.15	3.58	3.51	3.54

NOTES AND SOURCES:

THC	Total hydrocarbons
RHC	Reactive hydrocarbons (ARB reactivity Classes II and III)
NO_x	Oxides of nitrogen
VMT	Vehicle miles of travel

[1] Composite vehicle emission rates from California Air Resources Board, 1976b. Exhaust THC and NO_x emission rates for light-duty autos and light-duty trucks have been corrected to reflect average "smog season" (March through October) ambient air temperature (59°F; see Appendix Table B-1). Temperature correction factors for 59°F normalized against correction factors for 75°C, based on equations presented in U. S. Environmental Protection Agency, 1976. Exhaust, evaporative, and crankcase hydrocarbon reactivity factors taken from California Air Resources Board, 1976b (see Appendix A-6).

[2] 1973 and 1974 emission rates from California Air Resources Board, 1976b. 1980-1995 exhaust THC and NO_x emission rates calculated from model year emission factors and average VMT distributions by age class as presented in U. S. Environmental Protection Agency, 1976. Hydrocarbon reactivity factors from Appendix A-6.

[3] Calculated from 1973 data on vehicles in use; projected percentage annual increase by vehicle type; and statewide average annual mileage by vehicle type as presented in California Air Resources Board, 1976b.

Table VI

COMPARISON OF EMISSION SOURCE GROWTH FACTORS

	Growth Factors Compatible With									
	D-100 Population Projection					"County Composite" Population Projection				
Source Category	1974	1980	1985	1990	1995	1974	1980	1985	1990	1995
Petroleum marketing[1]	1.00	1.14	1.26	1.38	1.52	1.00	1.25	1.39	1.54	1.86
Surface coatings[2]	1.00	1.42	1.77	2.33	2.88	1.00	1.52	1.95	2.74	3.52
Degreasing[2]	1.00	1.42	1.77	2.33	2.88	1.00	1.52	1.95	2.74	3.52
Dry cleaning[1]	1.00	1.14	1.26	1.38	1.52	1.00	1.25	1.39	1.54	1.86
Other solvent users[1]	1.00	1.14	1.26	1.38	1.52	1.00	1.25	1.39	1.54	1.86
Food processing[2]	1.00	1.26	1.48	1.78	2.07	1.00	1.34	1.63	2.09	2.54
Pesticide use[2]	1.00	1.04	1.08	1.13	1.18	1.00	1.10	1.19	1.32	1.44
Other industry fuel use[2]	1.00	1.42	1.77	2.33	2.88	1.00	1.52	1.95	2.74	3.52
Domestic and commercial fuel use[1]	1.00	1.14	1.26	1.38	1.52	1.00	1.25	1.39	1.54	1.86
Agricultural and range burning[2]	1.00	1.04	1.08	1.13	1.18	1.00	1.10	1.19	1.32	1.44
Other waste burning[1]	1.00	1.14	1.26	1.38	1.52	1.00	1.25	1.39	1.54	1.86
Miscellaneous area sources[1]	1.00	1.14	1.26	1.38	1.52	1.00	1.25	1.39	1.54	1.86
Trains and off-road vehicles[1]	1.00	1.14	1.26	1.38	1.52	1.00	1.25	1.39	1.54	1.86

NOTES AND SOURCES:

All growth factors normalized to 1974 as a base year.

[1] Growth factors directly proportional to population projections.

[2] Growth factors based on an index of economic activity, modified from D-100 based factors presented in California Air Resources Board, 1974b (see Exhibit A in Appendix A-5). 1985 and 1995 growth factors shown in Exhibit A of Appendix A-5 were normalized in 1974 as a base year assuming linear change in growth factors for the 1972-1975 period. For the "County Composite" population projection basis, the 1974-normalized, D-100 based growth factors for 1985 and 1995 were multiplied by the ratio of the "County Composite" projection to the D-100 projection. Growth factors for years other than 1985 or 1995 derived by linear interpolation.

Table VII

PROJECTED HYDROCARBON AND NITROGEN OXIDE EMISSIONS, D-100 POPULATION PROJECTION BASIS

	Projected Emissions (Tons Per Day, Annual Average)											
	1980			1985			1990			1995		
Source Category	THC	RHC	NO_x	THC	RHC	NO_x	THC	RHC	NO_x	THC	RHC	NO_x
Petroleum marketing	3.6	3.5	00	4.0	3.9	00	4.4	4.3	00	4.9	4.7	00
Solvent Users:												
Surface coatings	3.7	3.4	00	4.6	4.2	00	6.1	5.6	00	7.5	6.9	00
Degreasing	3.6	0.4	00	3.2	0.5	00	4.2	0.7	00	5.2	0.9	00
Dry cleaning	1.0	0	00	1.1	0	00	1.2	0	0	1.4	0	0
Other	3.5	2.6	0	3.9	2.9	0	4.3	3.2	0	4.7	3.5	0
Food Processing	0	0	1.0	0	0	1.2	0	0	1.4	0	0	1.7
Pesticides	3.4	3.4	0	3.6	3.6	0	3.7	3.7	0	3.9	3.9	0
Fuel Combustion:												
Power Plants	1.4	1.4	31.8	1.8	1.8	40.0	2.2	2.1	47.8	1.6	1.6	35.8
Other industry	0.1	0.1	13.9	0.2	0.2	17.3	0.2	0.2	22.8	0.3	0.3	28.2
Domestic and commercial	0.1	0.1	1.7	0.1	0.1	1.9	0.1	0.1	2.1	0.2	0.2	2.3
Waste Burning:												
Agriculture and range	1.0	0.5	0.1	1.1	0.5	0.1	1.1	0.6	0.1	1.2	0.6	0.1
Other	4.3	2.3	0	4.8	2.5	0	5.2	2.8	0	5.8	3.0	0
Total Stationary Sources	24.7	17.7	48.5	28.4	20.2	60.5	32.7	23.3	74.2	36.8	25.6	68.1
Miscellaneous Area Sources	1.7	1.1	0	1.9	1.3	0	2.1	1.4	0	2.3	1.5	0
Motor Vehicles-On-Road	37.0	34.1	28.2	25.0	23.1	27.7	22.6	20.9	30.5	23.7	21.9	34.5
Trains and Off-Road Vehicles	4.1	3.8	8.4	4.5	4.2	9.3	5.0	4.6	10.2	5.5	5.0	11.2
Aircraft	0.8	0.7	1.3	0.6	0.6	1.2	0.5	0.4	1.2	0.4	0.4	1.2
Total Mobile Sources	41.9	38.6	37.9	30.1	27.9	38.2	28.1	25.9	41.9	29.6	27.3	46.9
TOTAL EMISSIONS	68.3	57.4	86.4	60.4	49.8	98.7	62.9	50.6	116.1	68.7	54.4	115.0
Percent of Emissions From:												
Stationary Sources	36.2	30.8	56.1	47.0	40.9	61.3	52.0	46.0	63.9	53.6	47.1	59.2
Miscellaneous Area Sources	2.5	1.9	0	3.1	2.6	0	3.3	2.8	0	3.3	2.8	0
Mobile Sources	61.3	67.2	43.9	49.8	56.5	38.7	44.7	51.2	36.1	43.1	50.2	40.8

NOTES AND SOURCES:

THC Total hydrocarbons.
RHC Reactive hydrocarbons (ARB reactivity Classes II and III.
NO_x Oxides of nitrogen.

Except for power plants, motor vehicles and aircraft, emissions projections are based on 1974 average daily emissions (Table III) times the appropriate growth factor listed in Table VI.

Power plant THC and NO_x emissions based on the following annual power generation assumptions (see Exhibit C, Appendix A-5):

1980	8 million megawatt-hours (44% capacity factor).
1985	10 million megawatt-hours (55% capacity factor).
1990	12 million megawatt-hours (66% capacity factor).
1995	9 million megawatt-hours (70% capacity factor following retirement of 582 megawatts of capacity in 1992 as projected in California Energy Resources Conservation and Development Commission, 1976).

Fuel oil assumed to be the exclusive fuel (Exhibit C, Appendix A-5). THC and NO_x emission factors from California Air Resources Board, 1976b (Exhibit 1). Hydrocarbon reactivity factor from Appendix A-6.

Motor vehicle emissions based on adjusted MCTS VMT projections (Table IV) and VMT-weighted, class composite vehicle emission factors for Monterey County (Table V).

Aircraft emissions based on weighted composite emission factors developed in Appendix A-5 (see Exhibit F) and D-100 population projections:

$$\text{19— emissions} = \text{1974 emissions} \times \frac{\text{19— Population}}{\text{1974 Population}} \times \frac{\text{19— Emission Factor}}{\text{1975 Emission Factor}}$$

1980 aircraft emissions factor = 1975 value; 1990 emission factor extrapolated from data in Exhibit F of Appendix A-5.

Table VIII

PROJECTED HYDROCARBON AND NITROGEN OXIDE EMISSIONS, COUNTY COMPOSITE POPULATION PROJECTION BASIS

Source Category	Projected Emissions (Tons Per Day, Annual Average)											
	1980			1985			1990			1995		
	THC	RHC	NO_x	THC	RHC	NO_x	THC	RHC	NO_x	THC	RHC	NO_x
Petroleum Marketing	4.0	3.9	0	4.4	4.3	0	4.9	4.8	0	6.0	5.8	0
Solvent Users:												
Surface coatings	4.0	3.6	0	5.1	4.7	0	7.1	6.6	0	9.2	8.4	0
Degreasing	2.7	0.5	0	3.5	0.6	0	4.9	0.8	0	6.3	1.1	0
Dry cleaning	1.1	0	0	1.3	0	0	1.4	0	0	1.7	0	0
Other	3.9	2.9	0	4.3	3.2	0	4.8	3.5	0	5.8	4.3	0
Food Processing	0	0	1.1	0	0	1.3	0	0	1.7	0	0	2.0
Pesticides	3.6	3.6	0	3.9	3.9	0	4.4	4.4	0	4.8	4.8	0
Fuel Combustion:												
Power plants	1.4	1.4	31.8	1.8	1.8	40.0	2.2	2.1	47.8	1.6	1.6	35.8
Other industry	0.2	0.2	14.9	0.2	0.2	19.1	0.3	0.3	26.9	0.4	0.4	34.5
Domestic and commercial	0.1	0.1	1.9	0.1	0.1	2.1	0.2	0.2	2.3	0.2	0.2	2.8
Waste Burning:												
Agriculture and range	1.1	0.6	0.1	1.2	0.6	0.1	1.3	0.7	0.1	1.4	0.7	0.1
Other	4.8	2.5	0	5.3	2.8	0	5.9	3.1	0	7.1	3.7	0
Total Stationary Sources	26.9	19.3	49.8	31.1	22.2	62.6	37.4	26.5	78.8	44.5	31.0	75.2
Miscellaneous Area Sources	1.9	1.3	0	2.1	1.4	0	2.3	1.5	0	2.8	1.9	0
Motor Vehicles-On-Road	41.0	37.7	31.2	27.5	25.4	30.5	25.1	23.2	33.9	29.0	26.8	42.2
Trains and Off-Road Vehicles	4.5	4.1	9.3	5.0	4.6	10.3	5.5	5.1	11.4	6.7	6.1	13.8
Aircraft	0.9	0.8	1.4	0.7	0.7	1.3	0.6	0.5	1.3	0.5	0.5	1.5
Total Mobile Sources	46.4	42.6	41.9	33.2	30.7	42.1	31.2	28.8	46.6	36.2	33.4	57.5
TOTAL EMISSIONS	75.2	63.2	91.7	66.4	54.3	104.7	70.9	56.8	125.4	83.5	66.3	132.7
Percent of Emissions From:												
Stationary sources	35.8	30.5	54.3	46.8	40.9	59.8	52.8	46.7	62.8	53.3	46.8	56.7
Miscellaneous area sources	2.5	2.1	0	3.2	2.6	0	3.2	2.6	0	3.4	2.9	0
Mobile sources	61.7	67.4	45.7	50.0	56.5	40.2	44.0	50.7	37.2	43.4	50.4	43.3

NOTES AND SOURCES:

THC	Total hydrocarbons.
RHC	Reactive hydrocarbons (ARB reactivity Classes II and III.
NO_x	Oxides of nitrogen.

Except for power plants, motor vehicles, and aircraft, emissions projections are based on 1974 average daily emissions (Table III) times the appropriate growth factor listed in Table VI.

Power plant THC and NO_x emissions based on the following annual power generation assumptions (see Exhibit C, Appendix A-5):

1980	8 million megawatt-hours (44% capacity factor).
1985	10 million megawatt-hours (55% capacity factor).
1990	12 million megawatt-hours (66% capacity factor).
1995	9 million megawatt-hours (70% capacity factor following retirement of 582 megawatts of capacity in 1992 as projected in California Energy Resources and Development Commission, 1976).

Fuel oil assumed to be the exclusive fuel (Exhibit C, Appendix A-5). THC and NO_x emission factors from California Air Resources Board, 1976b (Exhibit 1). Hydrocarbon reactivity factor from Appendix A-6.

Motor vehicle emissions based on adjusted MCTS VMT projections (Table IV) and VMT-weighted, class-composite vehicle emission factors for Monterey County (Table V).

Aircraft emissions based on weighted, composite emission factors developed in Appendix A-5 (see Exhibit F) and County Composite population projections (Table 46 in EIS text:

$$\text{19— Emissions} = \text{1974 Emissions} \times \frac{\text{19— Population}}{\text{1974 Population}} \times \frac{\text{19— Emission Factor}}{\text{1974 Emission Factor}}$$

1980 emission factor = 1975 value; 1990 emission factor extrapolated from data in Exhibit F of Appendix A-5.

Exhibit 1

Emission Factors for Emissions from Fossil Fuel Electric Generating Plants in Tons Per Day/Million MWH Per Year

Pollutant	Fuel Type		
	Gas (Natural and Synthetic)	Fuel Oil	Coal
Oxides of Nitrogen (NO_x)	2.04	3.98	9.45
Particulate Matter (PM)	0.14	0.72	1.35
Sulfur Dioxide (SO_2)	0.54	14.58(S) where (S) represents sulfur content of fuel in %; e.g. 0.5% yields a factor of 7.29. Use 1% if no information available.	16.20
Total Organic Gases (TOG)	0.01	0.18	0.17
Carbon Monoxide (CO)	0.23	0.27	0.56

Source: California Air Resources Board, 1976b.

APPENDIX B

CLIMATE

Table B-1

AVERAGE MONTHLY TEMPERATURE AND PRECIPITATION
IN MONTEREY-SALINAS AREA

	STATION	PERIOD OF RECORD	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL	MAXIMUM TEMPERATURE	MINIMUM TEMPERATURE
TEMPERATURE	Salinas FAA AD	1945-1974	49.6	51.8	52.7	55.2	57.9	60.6	63.0	62.5	63.9	61.0	55.7	50.6	56.9	104	20
	Salinas 3E	1970-1974	50.5	53.2	54.2	54.9	58.0	60.9	62.0	62.8	63.5	59.6	54.6	50.0	56.5	106	24
	Monterey FAA AD	1972-1974	50.1	52.6	52.3	55.5	56.1	60.5	61.3	60.7	62.2	59.7	54.9	50.8	56.1	94	32
	Salinas 2E	1958-1968	50.3	52.2	53.1	55.5	57.9	60.8	61.9	63.3	63.7	62.0	55.9	51.1	57.1	102	23
	Monterey Nalf	1968-1971	51.4	52.3	53.0	51.6	55.8	58.9	60.1	60.2	61.3	57.1	54.7	50.6	55.5	101	28
	Monterey	1949-1974	50.6	51.6	52.9	54.1	55.7	59.2	59.2	60.3	62.2	60.6	56.6	52.0	56.4	101	23
	Carmel Valley	1959-1974	50.5	51.9	52.5	54.2	56.6	61.0	62.8	63.5	64.2	61.9	55.4	50.6	57.1	110	21
	Del Monte	1948	39.1	47.2	50.7	55.4	56.4	61.6	61.9	62.0	59.4	56.6	-	-	-	92	25
PRECIPITATION	Salinas FAA AP	1945-1974	3.62	1.76	1.91	1.34	0.25	0.09	0.03	0.04	0.06	0.53	2.69	2.82	13.67		
	Carmel Valley	1959-1974	3.98	2.97	2.26	1.43	0.26	0.11	0.03	0.04	0.18	0.54	2.64	2.87	17.31		
	Salinas 2E	1958-1969	2.97	2.36	1.61	1.33	0.19	0.12	0.02	0.07	0.64	0.35	1.65	2.20	13.66		
	Salinas 3E	1970-1974	2.84	1.82	2.21	1.36	0.18	0.16	0.09	0.00	0.05	0.95	3.58	3.66	16.15		
	Spreckels Hwy Bridge	1945-1973	7.54	2.03	1.96	1.21	0.31	0.08	0.03	0.03	0.24	0.98	1.76	2.66	13.69		
	Monterey	1949-1974	4.23	2.60	2.77	1.66	0.50	0.21	0.06	0.10	0.28	0.61	3.53	3.28	18.55		
	Fort Ord	1958-1974	3.43	3.42	1.51	.85	0.10	0.07	0.03	0.14	0.08	0.75	3.21	2.74	16.31		
	Monterey Nalf	1958-1972	4.61	2.86	1.52	1.17	0.08	0.10	0.00	0.02	0.09	0.25	1.88	2.72	15.32		
	Monterey FAA A	1972-1974	3.73	2.65	2.65	1.24	0.00	0.00	0. 4	0.00	0.02	1.99	3.62	2.03	18.86		
	Del Monte	1950-1951	4.26	2.13	1.01	.86	.25	0.00	0.00	0.00	0.00	1.70	3.93	-	-		

Source: ESSA U. S. Department of Commerce data presented in Engineering Science, Inc., 1975.

Table B-2

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
P. O. Box 8247
San Francisco, California 94128

Date: May 29, 1975

Reply to Attn of: Official in Charge

Subject: Wind Data

To: John L. Maloney, Monterey Bay Unified Air Polution Control District

We have some of the data for which you asked in your letter of May 20, 1975. The data are summarized below.

Percent of time and average velocity of wind from the various directions for the stations listed.

	Monterey 36° 35'N 121° 53'W		Paso Robles 35° 36'N 120° 39'W		Salinas 36° 40'N 121° 36'W	
	Pct.	Ave.	Pct.	Ave.	Pct.	Ave.
N	16.0	7.2	8.4	6.3	4.3	6.3
NNE	*	.5	4.4	5.0	1.2	5.7
NE	1.5	3.3	4.8	4.8	1.1	4.4
ENE	0	-	3.3	7.4	0.6	4.9
E	11.8	4.9	2.8	5.5	2.0	5.5
ESE	*	0.4	2.8	3.3	4.2	9.8
SE	6.3	4.4	3.3	2.8	16.0	11.1
SSE	0	-	3.3	5.0	3.3	8.5
S	3.6	6.9	3.1	10.5	2.3	5.6
SSW	*	1.2	6.0	8.1	0.7	4.9
SW	5.5	10.8	9.0	7.9	2.5	6.0
WSW	0.9	4.3	8.5	9.5	3.4	8.2
W	24.1	7.7	3.2	4.6	12.5	9.5
WNW	0.8	1.2	3.6	6.4	14.3	10.3
NW	22.8	8.4	8.5	7.6	18.9	9.1
NNW	1.5	5.8	9.8	9.3	5.5	8.0
CALM	4.0	-	15.4	-	7.2	-

* Less than 1/2 of one persent.

Source: Abercrombie, pers. comm.

Table B-3

WIND FREQUENCY DISTRIBUTIONS FOR HOLLISTER

Direction	Percent Frequency	Average Strength (mph)
W	32.9	8.5
SW	16.5	12.6
E	12.1	3.4
N	7.2	4.1
NW	6.3	4.9
S	5.5	5.4
WSW	5.1	10.0
SE	4.3	4.5
WNW	2.9	7.0
NE	2.0	2.2
ESE	0.6	4.6
SSW	0.4	2.2
NNW	0.2	1.3
NNE	0.2	0.6
SSE	0.2	1.4
ENE	0.1	1.3
CALM	3.3	--

Source: National Weather Service.

Table B-4

WIND CONDITIONS ON DAYS WITH HIGH OXIDANT LEVELS IN THE MONTEREY BAY AREA

Date		Direction[1]	Wind Speed[1]		Maximum 1-Hour Oxidant Level[2]		
			Knots	MPH	Gonzales	Salinas	Monterey
4-10-73		300-320° (NW)	8-15	7-13	0.125	0.177	0.109
6-19-73		290-350° (N,WW)	8-13	7-11.3	0.094	0.031	0.031
6-20-73	AM:	110-130° (E,SE)	8-12	7-10.4	0.101	0.055	0.055
	PM:	310-330° (NW)	12-14	10.4-12.2			
6-21-73		310-340° (NW)	10-18	8.7-15.6	0.078	0.039	0.047
6-25-73		290-350° (N,NW)	8-14	7-12.2	0.047	0.031	0.023
6-26-73		330-350° (N,NW)	12-16	10.4-13.9	0.078	0.047	0.047
9-27-73		130-140° (SE)	11-14	9.6-12.2	0.047	0.078	0.109
9-28-73		310-330° (NW)	8-12	7-10.4	0.078	0.070	0.101
9-29-73		300-350° (N,NW)	10-12	8.7-10.4	0.062	0.047	0.047
10-5-73		290-340° (NW)	11-14	9.6-12.2	0.055	0.055	0.055
10-6-73	AM:	120-140° (SE)	9-10	7.8-8.7	0.039	0.055	0.070
	PM:	290-010° (N,NW)	6-10	5.2-8.7			
10-13-73		310-330° (NW)	8-10	7-8.7	0.070	0.086	0.086
10-14-73		320-340° (N,NW)	9-12	7.8-10.4	0.055	0.055	0.094
10-15-73		300-310° (W,NW)	8-12	7-10.4	0.055	0.062	0.109
10-16-73		300-320° (NW)	8-10	7-8,7	0.070	0.094	0.062
10-17-73		310-330° (NW)	10-12	8.7-10.4	0.062	0.062	0.055
10-29-73		300-020° (N,NW)	8-12	7-10.4	0.047	0.031	0.039
10-30-73		110-140° (E,SE)	8-18	7-15.6	0.062	0.101	0.062
10-31-73		320-350° (N,NW)	10-12	8.7-10.4	0.062	0.094	0.086

NOTES AND SOURCES:

[1] Wind speeds and directions at Salinas airport (Campbell, pers. comm.).

[2] Values in parts per million by volume, corrected by 0.78 factor (see Appendix A-2) from values reported in California Air Resources Board, 1973b.

APPENDIX C

SOILS

Table C-1

TABLE OF SOIL CHARACTERISTICS AND QUALITIES

[illegible]

SURVEY AREA MONTEREY COUNTY GENERAL SOIL MAP

Date August 1967 Prepared by TDC, LWW, JHK, ROG, CJW, JMC, DCE, CSB Sheet 1 of 8

Map Symbol	Soil Name	Position	Profile (dry)			Natural Drainage	Subsoil Perm	Runoff	Erosion Hazard	Effective Depth (inches)	A.W.C. 1/ (inches)	Inherent Fertility	Present Land Use
			Surface Layer	Subsoil	Substratum or Parent Material								
GROUP 1 -	AREAS DOMINATED BY MODERATELY DEEP TO VERY DEEP, NEARLY LEVEL, SOMEWHAT POORLY TO VERY POORLY DRAINED SOILS												
Ao	Alviso association	Tidal basins											
	Alviso		Gray silty clay loam, blocky, hard, neutral, 5 to 10"	Light gray silty clay loam, blocky, hard, alkaline, 10 to 40"	Greenish gray stratified sands, peat, muck, & clay sl. acid .. alkaline 10-15"+	Very poorly	Slow	Very slow	None	18-24	3-4	Very low	Recreation Wildlife
CM-Pb	Clear Lake-Pacheco association	Nearly level basins and alluvial plains											
	Clear Lake		Dark gray clay, blocky, very hard, moderately alkaline 10 to 15"	Dark gray clay, massive, extremely hard, moderately alkaline 24 to 18"	Mottled grayish brown stratified clay, massive, very hard, calcareous	Somewhat poorly	Slow	Very slow	None	48-60+	8-11	High	Cropland
	Pacheco		Dark gray clay loam, blocky, very hard, neutral 15 to 35"	Grayish brown loam, massive, very hard, mod. alkaline 20 to 30"	Mottled brownish gray silty clay loam, massive, very hard, calcareous	Somewhat poorly	Moderate to mod. slow	Slow	Slight	36-60	6-10	High	Row Crops
GROUP 2 -	AREAS DOMINATED BY MODERATELY DEEP TO VERY DEEP, NEARLY LEVEL TO STRONGLY SLOPING WELL TO EXCESSIVELY DRAINED SOILS												
cp	Cropley association	Nearly level fans and alluvial plains											
	Cropley		Dark gray clay, weak granular, moderately alkaline 8 to 12"	Grayish brown silty clay prismatic, very hard, alkaline 12 to 24"	Grayish brown clay loam massive, hard, moderately alkaline 24"+	Well	Slow	Medium	None	60+	10-12	High	Cropland
Fc A	Farallone association, 0 to 2 percent slopes	Nearly level fans and alluvial plains											
	Farallone		Dark grayish brown gravelly sandy loam, sl. hard, neutral 10 to 12"	Brown coarse sandy loam, blocky, slightly hard, mildly alkaline 20 to 28"	Brown loamy coarse sand, massive, soft, alkaline 20 to 30"+	Well	Moderate to mod. rapid	Slow	Slight	60+	5-7.5	Moderate	Cropland
Mt-Rw AC	Metz-Riverwash association, 0 to 9 percent slopes	Nearly level to moderately sloping flood plains											
	Metz		Light gray silts and sands loose, calcareous 8 to 20"	Light gray stratified sands, loose, calcareous 10 to 30"	Light gray, stratified sands and gravels, calcareous 10 to 40"+	Somewhat excessive	Rapid	Slow	None	60+	4-5	Low	Pasture Cropland Range
	Riverwash		Stratified sand, gravels and stones along active stream channel; barren			Excessive	Very rapid	Very rapid	Very high	Variable	1-2	Very low	Usually barren
MM-Mt	Mocho-Metz association	Nearly level alluvial plains											
	Mocho		Grayish brown loam, weak blocky, slightly hard, calcareous 14 to 20"	Light grayish brown, sandy loam, massive, hard calcareous 20 to 26"	Pale brown loamy fine sand, massive, loose calcareous 14 to 26"+	Well	Moderately rapid	Slow	None	60+	7.5-8	Moderately high	Cropland
	Metz		Light brownish gray fine sandy loam, slightly hard calcareous 10 to 25"	Light brownish gray fine sand, massive, loose, calcareous 10 to 30"	Light brownish gray, stratified sands, loose calcareous 10 to 40"+	Well	Rapid	Slow	None	60+	5-6	Moderate	Cropland
Sd-MM	Salinas-Mocho association	Nearly level alluvial plains, fans and terraces											
	Salinas		Very dark gray clay loam, blocky, very hard, mod. alkaline 10 to 15"	Dark gray or grayish brown silt loam, blocky, mod. alkaline 20 to 30"	Grayish brown sandy loam, massive, soft, calcareous 35"+	Well	Moderate to mod. slow	Medium	None	60+	8-11	High	Cropland
	Mocho		Grayish brown silty clay loam, blocky, hard, calcareous 18 to 24"	Light grayish brown silty clay loam, massive, hard, calcareous 16-22"	Light brownish gray, silty clay loam, massive, hard, calcareous 20-30"	Well	Moderate to mod. slow	Medium	Slight	60+	8-10	High	Cropland Range
GROUP 3 -	AREAS DOMINATED BY DEEP AND VERY DEEP, COARSE TO MODERATELY COARSE TEXTURED SOILS ON STABILIZED SAND DUNES AND SOFT SANDSTONES												
[illegible]	Arnold association, 15 to 30 percent slopes, eroded	Steep to very steep hills											
	Arnold		Grayish brown loamy sand weak, blocky, sl. hard, medium acid 10 to 15"	Brown loamy sand, massive slightly hard, medium acid 10 to 20"	Pale brown to light gray sand, massive, soft, neutral - medium acid	Excessive	Rapid	Medium	Moderate	30-60	2-4	Low	Range Pasture Wildlife

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TABLE OF SOIL CHARACTERISTICS AND QUALITIES

SURVEY AREA MONTEREY COUNTY GENERAL SOIL MAP
Date August 1967
Prepared by TDC, LMW, JHK, ROG, CJW, JMC, DCE, CSB
Sheet 2 of 8

Map Symbol	Soil Name	Position	Profile (dry)			Natural Drainage	Subsoil Perm.	Runoff	Erosion Hazard	Effective Depth (inches)	A.W.C. 1/ (inches)	Inherent Fertility	Present Land Use
			Surface Layer	Subsoil	Substratum or Parent Material								
Mz-Bl/D	Marina-Baywood association, 2 to 15 percent slopes	Gently sloping to rolling stabilized dune land											
	Marina		Grayish brown loamy sand loose, slightly hard, medium acid 15 to 40"	Yellowish brown loamy sand, massive, slightly hard, medium acid	Yellowish brown loamy sand, massive, loose, slightly acid	Somewhat excessive	Rapid	Medium	Moderate	60+	4-6	Very low	Pasture
	Baywood		Dark grayish brown sand, weak granular, slightly hard, sl. acid 15 to 30"	Pale brown sand, massive slightly hard, medium acid 5 to 10"	Very pale brown sand, loose, slightly acid	Excessive	Very rapid	Slow	High	60+	2-3	Very low	Range
GROUP 5 -	AREAS DOMINATED BY MODERATELY DEEP TO VERY DEEP, WELL DRAINED, NEARLY LEVEL TO MODERATELY STEEP SOILS WITH MODERATE TO SLOWLY PERMEABLE SUBSOILS												
CG/A	Chualar association, 0 to 2 percent slopes	Nearly level alluvial fans and low terraces											
	Chualar		Grayish brown sandy loam, granular or blocky, sl. hard, neutral 12 to 30"	Brown clay loam, blocky, very hard, alkaline 15 to 30"	Brown stratified sands and loams, loose, alkaline 15 to 25"+	Well	Moderately slow	Medium	Slight	60+	8-10	Moderately high	Cropland
CG-Fc/C	Chualar-Farallone association, 5 to 9 percent slopes	Moderately sloping terraces											
	Chualar		Grayish brown loam, granular or blocky, hard, neutral 12 to 24"	Brown clay loam, blocky, very hard, alkaline 15 to 20"	Brown stratified sands and loams, loose, alkaline 15 to 25"+	Well	Moderately slow	Medium	Slight	60+	8-10	Mod. to moderately high	Cropland Range
	Farallone		Grayish brown gravelly sandy loam, blocky, sl. hard, neutral 6 to 10"	Dark brown sandy loam, massive, slightly hard, neutral 24 to 36"	Granite, cobbles and gravel, neutral	Well	Moderate to mod. rapid	Slow	Slight	36-48	4.5-7	Moderate	Cropland
Ek/HC	Elkhorn association, 2 to 9 percent slopes	Gently to moderately sloping coastal marine terraces											
	Elkhorn		Brown sandy loam, blocky, hard, neutral 10 to 20"	Brown sandy clay loam, massive, hard, medium acid 20 to 30"	Strong brown fine sandy loam, massive, very hard slightly acid	Well	Moderately slow	Slow	Slight to moderate	40-60	6.5-7.5	Moderate	Row Crops
GROUP 6 -	AREAS DOMINATED BY SHALLOW TO DEEP, WELL TO SOMEWHAT POORLY DRAINED, GENTLY SLOPING TO STEEP SOILS WITH MODERATELY SLOWLY TO VERY SLOWLY PERMEABLE SUBSOILS												
An-Gq/W	Antioch-Gloria association, 2 to 9 percent slopes	Gently to moderately sloping terraces											
	Antioch		Grayish brown loam, blocky, sl. hard, strongly acid 10 to 24"	Yellowish brown clay, columnar, very hard, alkaline 20 to 30"	Very pale brown sandy clay loam, blocky, hard, mod. alkaline 30-40"+	Moderately well	Slow to very slow	Medium	Slight	10-24	3-6	Low	Pasture Hay Cropland
	Gloria		Brown loam, massive, hard, medium & slightly acid 12 to 24"	Reddish brown clay, prismatic, extremely hard alkaline 13 to 18"	Reddish brown indurated hardpan 20 to 36"+	Well to moderately well	Very slow	Medium	Moderate	20-30	4-5	Low	Cropland Range
An-Gq/DE-2	Antioch-Gloria association, 9 to 30 percent slopes, eroded	Strongly sloping to moderately steep high terraces											
	Antioch		Grayish brown loam, blocky, slightly hard, strongly acid 10 to 24"	Yellowish brown clay, columnar, very hard, alkaline 20 to 30"	Very pale brown sandy clay loam, blocky, very hard, mod. alkaline 30-40"+	Moderately well	Slow	Medium	High	10-24	3-6	Low	Range Pasture
	Gloria		Brown loam, massive, hard medium and slightly acid 8 to 20"	Reddish brown clay, prismatic, extremely hard, alkaline 10 to 15"	Reddish brown indurated hardpan 20 to 36"+	Well	Very slow	Medium to rapid	High	8-20	2-4	Low to very low	Range Pasture
Gq-Pv/EF-2	Gloria-Placentia association, 15 to 50 percent slopes, eroded	Moderately steep to steep dissected high terraces											
	Gloria		Brown loam, massive, hard medium and slightly acid 8 to 20"	Reddish brown clay, prismatic, extremely hard alkaline 10 to 15"	Reddish brown indurated hardpan 20 to 36"+	Well	Very slow	Rapid	Very high	8-20	1-3	Very low to low	Range
	Placentia		Brown sandy loam, massive, hard, medium acid 6 to 24"	Dark reddish brown clay prismatic, very hard, alkaline 12 to 36"	Brown gravelly sandy loam, massive, hard, alkaline 10 to 24"+	Well	Slow	Medium	Slight	18-30	2-4	Low	Cropland Range
Nc/[illegible]	Narlon association, 2 to 9 percent slopes	Gently to moderately sloping terraces											
	Narlon		Gray loamy fine sand, fine granular, soft, medium acid 12 to 29"	Mottled gray & yellowish brown clay, prismatic very hard, strongly acid	Light gray or white sandy clay, massive, very hard, very strongly acid	Somewhat poorly	Very slow	Slow	Slight	12-29	3-5	Very low	Woodland

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TABLE OF SOIL CHARACTERISTICS AND QUALITIES

SURVEY AREA MONTEREY COUNTY GENERAL SOIL MAP

Date August 1967 Prepared by TDC, LWW, JHK, ROG, CJW, JMC, DCE, CSB Sheet 3 of 8

Map Symbol	Soil Name	Position	Profile (dry)			Natural Drainage	Subsoil Perm.	Runoff	Erosion Hazard	Effective Depth (inches)	A.W.C. 1/ (inches)	Inherent Fertility	Present Land Use
			Surface Layer	Subsoil	Substratum or Parent Material								
GROUP 7 -	AREAS DOMINATED BY MOSTLY CLAYEY SOILS ON GENTLY ROLLING TO MODERATELY STEEP HILLS												
DI/CD	Diablo association, 5 to 15 percent slopes	Moderately to strongly sloping hills											
	Diablo		Very dark gray clay, blocky, very hard, neutral 18 to 24"	Dark gray clay, blocky, very hard, neutral 20 to 36"	Soft shale and sandstone, shattered, calcareous	Well	Slow	Slow	Slight	38-60	6-9	High	Cropland Range
GROUP 8 -	AREAS DOMINATED BY SHALLOW TO DEEP, MODERATELY COARSE TO FINE TEXTURED SOILS FORMED ON USUALLY ACID SHALES AND SANDSTONES												
SL-Gs/EF	Santa Lucia-Gazos association, 15 to 50 percent slopes	Moderately steep and steep hills and mountains											
	Santa Lucia		Gray shaly clay loam, granular, weakly coherent strongly acid 12 to 15"	Grayish brown very shaly clay, granular, strongly acid 12 to 15"	Pale brown to white siliceous shales	Well	Moderate	Medium	Moderate	24-36	4-6	Moderate	Range Dry Cropland
	Gazos		Grayish brown shaly loam granular, soft, neutral 15 to 25"	Grayish brown shaly loam, blocky, slightly hard, neutral 5 to 15"	Light gray fractured shale, neutral	Well	Moderate	Medium	Moderate	20-40	5-7	Moderate	Range Dry Cropland
GROUP 10 -	AREAS DOMINATED BY MODERATELY COARSE TO MODERATELY FINE TEXTURED, VERY SHALLOW TO DEEP UPLAND SOILS FORMED ON GRANITIC BEDROCK												
CN-SH/FG-2	Cieneba-Sheridan association, 50 to 75 percent slopes, eroded	Steep to extremely mountains											
	Cieneba		Brown gravelly sandy loam, granular, slightly hard, sl. acid 5 to 20"	Strongly weathered granite	Strongly weathered granite	Excessive	Moderately rapid	Very rapid	Very high	5-20	1-3	Low	Wildlife Watershed Recreation
	Sheridan		Dark grayish brown sandy loam, granular, soft, slightly acid 8 to 14"	Dark grayish brown gravelly sandy loam, granular, medium acid	Massive, weathered coarse crystalline granite	Well	Moderately rapid	Very rapid	Very high	20-36	2-4	Moderate	Wildlife Watershed Recreation
				10 to 22"									
Mc/T	McCoy association, 30 to 50 percent slopes	Steep hills											
	McCoy		Dark brown clay loam, blocky, hard, neutral 16 to 20"	Dark brown heavy clay loam, blocky, hard, alkaline 16 to 36"	Strongly weathered granite	Well	Moderately slow	Medium to rapid	Moderate	36-48	5-8	Moderately high	Range
SH/FG	Sheridan association, 30 to 75 percent slopes	Steep and very steep mountains		12 to 14"									
	Sheridan		Dark grayish brown gravelly loam, granular, sl. hard, sl. acid 12 to 24"	Dark grayish brown gravelly sandy loam, granular medium acid 12 to 24"	Massive, weathered coarse crystalline granite	Well	Moderate or mod. rapid	Medium	Moderate	30-48	5-6	Moderately high	Range
Vt/FG-2	Vista association, 30 to 75 percent slopes, eroded	Steep and very steep mountains											
	Vista		Brown sandy loam, granular, slightly hard, medium acid 5 to 10"	Light yellowish brown sandy loam, massive medium acid 10 to 14"	Light yellowish brown weathered granite	Somewhat excessive	Moderately rapid	Rapid	High	20-24	3-4	Moderate or low	Range

1/ Total available water holding capacity within effective soil depth

Source: U. S. Department of Agriculture, Soil Conservation Service, 1968.

CP-106A
2/2/66

Table C-2

INDEX of SOIL MAPPING UNITS and INTERPRETIVE GROUPINGS

SURVEY AREA MONTEREY COUNTY GENERAL SOIL MAP

Name TDC, LWW, JHK, RDG CJW, JMC, DCE, CSB
Date August 1967
Page 1 of 6

MAP SYMBOL	SOIL NAME	Percent 1/ of Association	INTERPRETIVE GROUPING										
			Capability Unit		Vegetative Group	Hydrologic Group	Range Site	Shrink-Swell Behavior	Septic Tank Filter Fields	SEWAGE LAGOON		Corrosivity Rating for Untreated Steel Pipe	Allowable Soil Pressure
			Irrigated	Dry						Lagoon Basin Floors (Impoundment)	Embankment Material		
GROUP 1 - AREAS DOMINATED BY MODERATELY DEEP TO VERY DEEP, NEARLY LEVEL, SOMEWHAT POORLY TO VERY POORLY DRAINED SOILS													
Ao	Alviso association												
	Alviso	65		VIIIw6	J	D	3/	High shrink 2/ low swell	Severe	Slight	Moderate	High	Severe
		(35)											
CM-Pb	Clear Lake-Pacheco association												
	Clear Lake	50	IIw5 2/		E	D 2/	3/	High 2/	Severe 2/	Slight 2/	Moderate	High	Moderate
	Pacheco	35	IIw2		E	C	3/	Moderate	Moderate	Moderate	Moderate	High	Moderate
		(15)											
GROUP 2 - AREAS DOMINATED BY MODERATELY DEEP TO VERY DEEP, NEARLY LEVEL TO STRONGLY SLOPING WELL TO EXCESSIVELY DRAINED SOILS													
Cp	Crepley association												
	Crepley	75	IIs5		C	D	3/	High	Severe	Slight	Moderate	High	Moderate
		(25)											
Fc/A	Farallone association, 0 to 2 percent slopes												
	Farallone	80	IIs4		A	A	3/	Low	Slight	Severe	Moderate	Low	Moderate
		(20)											
MC-RW/AC	Metz-Riverwash association, 0 to 9 percent slopes												
	Metz	50	IVe4 2/		B 2/	A	Sandy	Low	Moderate 2/	Severe	Severe	Low	Severe
	Riverwash	30		VIIIw4	J	A	Sandy	Low	Severe	Severe	Severe	Low	Severe
		(20)											
MM-MC	Mocho-Metz association												
	Mocho	50	I 2/		A	B	3/	Moderate 2/	Slight	Severe	Moderate 2/	Low	Moderate 2/
	Metz	30	IIs4		A	B	3/	Low	Slight	Severe	Severe	Low	Severe
		(20)											
Sd-MM	Salinas-Mocho association												
	Salinas	40	I		A	C	3/	Moderate	Moderate	Slight	Moderate	Moderate	Moderate
	Mocho	30	I		A	C	3/	Moderate	Moderate	Slight	Moderate	Moderate	Moderate
		(30)											
GROUP 4 - AREAS DOMINATED BY DEEP AND VERY DEEP, COARSE TO MODERATELY COARSE TEXTURED SOILS ON STABILIZED SAND DUNES AND SOFT SANDSTONES													
AE/EF-2	Arnold association, 15 to 50 percent slopes, eroded												
	Arnold	70		VIIs4	J	B	Sandy	Low	Severe	Severe	Severe	Low	Moderate
		(30)											
Mg-Bl/LD	Marina-Baywood association, 2 to 15 percent slopes												
	Marina	50	IVe4		B	A	Sandy	Low	Severe	Severe	Severe	Low	Moderate
	Baywood	40	IVe4		B	A	Sandy	Low	Severe	Severe	Severe	Low	Moderate
		(10)											
GROUP 3 - AREAS DOMINATED BY MODERATELY DEEP TO VERY DEEP, WELL DRAINED, NEARLY LEVEL TO MODERATELY STEEP SOILS WITH MODERATE TO SLOWLY PERMEABLE SUBSOILS													
CG/A	Chualar association, 0 to 2 percent slopes												
	Chualar	65	I		A	C	3/	Moderate	Moderate	Slight	Slight	Moderate	Moderate
		(35)											
CG-Fc/C	Chualar-Farallone association, 5 to 9 percent slopes												
	Chualar	50	IIIe3 2/		A	C 2/	Loamy	Moderate 2/	Moderate	Moderate	Slight 2/	Moderate 2/	Moderate
	Farallone	25	IIIe4		A	A	Loamy	Low	Moderate	Severe	Moderate	Low	Moderate
		(25)											
Ek/BC	Elkhorn association, 2 to 9 percent slopes												
	Elkhorn	75	IIIe1		A	C	Loamy	Moderate	Moderate	Moderate	Slight	Moderate	Moderate
		(25)											

[illegible]
2/2/66

INDEX of SOIL MAPPING UNITS and INTERPRETIVE GROUPINGS

SURVEY AREA MONTEREY COUNTY GENERAL SOIL MAP

Name TDC, LWW, JHK, RDG, CJW, JMC, DCE, CSB
Date August 1967
Page 3 of 6

MAP SYMBOL	SOIL NAME	Percent 1/ of Association	Capability Unit		Vegetative Group	Hydrologic Group	Range Site	Shrink-Swell Behavior	Septic Tank Filter Fields	SEWAGE LAGOON		Corrosivity Rating for Untreated Steel Pipe	Allowable Soil Pressure
			Irrigated	Dry						Lagoon Basin Floors (Impoundment)	Embankment Material		
GROUP 6 - AREAS DOMINATED BY SHALLOW TO DEEP, WELL TO SOMEWHAT POORLY DRAINED, GENTLY SLOPING TO STEEP SOILS WITH MODERATELY SLOWLY TO VERY SLOWLY PERMEABLE SUBSOILS													
Ax-Cg / bC	Antioch-Gloria association, 2 to 9 percent slopes												
	Antioch	50	IIIe3		D	D	Claypan	High	Severe	Moderate	Slight	High	Moderate 2/
	Gloria	40	IIIe3		D	D	Claypan	High	Severe	Moderate	Slight	High	Slight
		(10)											
Ax-Gg / DE-2	Antioch-Gloria association, 9 to 30 percent slopes, eroded												
	Antioch	50		VIe3	D	D	Claypan	High	Severe	Severe	Slight	High	Moderate 2/
	Gloria	40		VIe3	D	D	Claypan	High	Severe	Severe	Slight	High	Slight
		(10)											
Gg-Pv / EF-2	Gloria-Placentia association, 15 to 30 percent slopes, eroded												
	Gloria	35		VIe3	J 2/	D	Shallow claypan	High	Severe	Severe	Slight	High	Slight
	Placentia	25		VIe3	D	D	Shallow claypan	High	Severe	Severe	Slight	High	Slight
		(40)											
[illegible]	Marion association, 2 to 9 percent slopes												
	Marion	70	IIIe3		L	D	Claypan	High	Severe	Moderate	Slight	High	Moderate
		(30)											
GROUP 7 - AREAS DOMINATED BY MOSTLY CLAYEY SOILS ON GENTLY ROLLING TO MODERATELY STEEP HILLS													
Dl / CD	Diablo association, 5 to 15 percent slopes												
	Diablo	70	IIIe5		C	D	Clayey	High	Severe	Severe	Moderate	High	Moderate
		(30)											
GROUP 8 - AREAS DOMINATED BY SHALLOW TO DEEP, MODERATELY COARSE TO FINE TEXTURED SOILS FORMED ON USUALLY ACID SHALES AND SANDSTONES													
Sk-Gz / EF	Santa Lucia-Gazos association, 15 to 50 percent slopes												
	Santa Lucia	60		VIe1 2/	G	C	Loamy	Low 2/	Severe	Severe	Moderate	High 2/	Moderate
	Gazos	25		VIe5	G	C	Loamy	Moderate	Severe	Severe	Moderate	Moderate	Moderate
		(15)											
GROUP 10 - AREAS DOMINATED BY MODERATELY COARSE TO MODERATELY FINE TEXTURED, VERY SHALLOW TO DEEP UPLAND SOILS FORMED ON GRANITIC BEDROCK													
Ck-SH / G-2	Cieneba-Sheridan association, 50 to 75 percent slopes, eroded												
	Cieneba	45		VIIIs1	J	B	3/	Low	Severe	Severe	Moderate	Low	Moderate
	Sheridan	45		VIIIe1	J	B	3/	Low	Severe	Severe	Moderate	Low	Moderate
		(10)											
Mc / F	McCoy association, 30 to 50 percent slopes												
	McCoy	55		VIe5	A	C	Loamy	High	Severe	Severe	Slight	Moderate	Moderate
		(45)											
SH / FG	Sheridan association, 30 to 75 percent slopes												
	Sheridan	50		VIIe4	J	B	Loamy	Low	Severe	Severe	Moderate	Low	Moderate
		(50)											
Vt / FG-2	Vista association, 30 to 75 percent slopes, eroded												
	Vista	60		VIIe4	J	B	Loamy	Low	Severe	Severe	Moderate	Low	Moderate
		(40)											

1/ Percent in (-) gives extent of unnamed soils in the associations. (See descriptions)
2/ Indicates rating to be used when coloring single purpose interpretive maps.
3/ Not used for range.

Source: U. S. Department of Agriculture, Soil Conservation Service, 1968.

APPENDIX D

SEISMIC AND GEOTECHNICAL

Table D-1[1]

MONTEREY COUNTY FAULTS

Fault	C.D.M.G. Report 13		U.S. Geological Survey		Burkland Report	
	Active[2]	Potentially Active	Active	Potentially Active	Active[3]	Potentially Active
San Andreas	X		X		X	
Vergeles		inactive		X		X
Gabilan Creek		not shown	named-not shown			X
Los Lobos		X		X		X
Reliz - Riconada		X		X		X
Harper Canyon		not shown	shown-not named			X
Berwick Canyon		X				X
Chupines and Corral de Tierra		X X		X X		X X
Jolon		X		X		X
Navy		not shown		X		X
Ord Terrace		not shown		X		X
Cypress Pt.-Seaside		not shown		X		X
Monterey Bay (zone)		X	X	X	X	X
Tularcitos		inactive		X		X
Lower Carmel Valley		X		X		X
Palo Colorado and San Gregoria	X		X		X	
Sur-Nacimiento		inactive	inactive			X

---

[1] Source: Burkland and Associates, 1975.

[2] Burkland Report Definitions:
Active - Those faults which have moved or have shown activity within the last 11,000 years.
Potentially Active - Those faults which have moved or have shown activity within the last 3,000,000 years.
Inactive - Those faults that have not moved or shown activity within the last 3,000,000 years.

[3] CDMG Report Definitions:
Active - Demonstrable activity during the last 200 years.
Potentially Active - Demonstrable activity between 200 and 2,000,000 years.
Inactive - Demonstrable activity more than 2,000,000 years ago.

Table D-2*

EVALUATION OF HAZARDS

	ENGINEERING					SEISMIC					
	EXPANSIVE SOILS	EROSION	EXCAVATION	GROUND WATER	SLOPE STABILITY	LURCH CRACKING	LATERAL SPREADING	VIBRATION DAMAGE	SUBSIDENCE & UPLIFT	GROUND RUPTURE	LIQUEFACTION
I	△ TO □+	△+	□ TO ○+	△+	NA	NA	NA	△+	NA	NA	NA
II	△ TO □+	△ TO ○+	□+	□+	△ TO □+	□ TO ○+	□+	△ TO ○+	□+	NA	□ TO ○+
III	△ TO □+	△ TO □+	△+	△+	□	□+	△+	□+	△ TO □+	NA	□ TO ○+
IV	□ TO ○+	□ TO ○+	△ TO □+	△ TO ○+	○ TO □+	□+ TO ○+	□+ TO ○+	□+ TO ○+	○+	NA	□ TO ○+
V	△+	△ TO ○+	□+	□+	△ TO ○+	△ TO ○+	△ TO □+	○+	□ TO ○+	○+	□ TO ○+
VI	○+	○	□+	○+	○	○+	○+	○	□ TO ○+	○+	□ TO ○+

△ MINOR □ MODERATE ○ MAJOR

NA GENERALLY NOT APPLICABLE

+ LOCALLY

The triangles indicate that the potential geotechnical hazard is of concern in less than about 10% of the zone so designated. The squares indicate that the potential hazard is of concern in less than about 40% of that zone, whereas the circles indicate that the potential hazard is of concern in more than about 40% of that zone. A cross is used as a modifier to indicate that a particular geotechnical hazard is a localized one as well as being a potential problem throughout the zone. The symbols, then, are intended to indicate the potential for distribution within a zone rather than the severity of the hazard within that zone.

* Source: Burkland and Associates, 1975.

APPENDIX E

SURFACE WATER QUALITY AND QUANTITY

Table E-1

SALINAS RIVER WATER QUALITY

	Highway 68*		Blanco Road*		Highway 1*	
Parameter	Recorded Units	Sample Period and Source**	Recorded Units	Sample Period and Source**	Recorded Units	Sample Period and Source**
Turbidity ppm formazin	1-34	6/75-9/75[4]	8-17	6/75-9/75[4]		
Specific conductance mmhos/cm^3	890	n.d.[3]			2,400	n.d.[3]
TDS ppm	360-1,480	1941-1971[2]			1,400	n.d.[3]
Hardness ppm	304	n.d.[3]			460	n.d.[3]
DO mg/l	8.6-11.4	6/75-9/75[4]	5.6-6.2	6/75-9/75[4]	3.0-17.6	4/72-10/72[6]
5-Day BOD mg/l	4.6-8.4	6/75-9/75[4]	3.1-7.9	6/75-9/75[4]		
Orthophosphate - P mg/l	0.00-0.45	6/75-9/75[4]	0.01-1.82	6/75-9/75	5.4	12/14/71[6]
Total P mg/l	0.39-13	11/71-6/72[1]			6.3	11/4/71[6]
Nitrate as N mg/l	13	n.d.[3]			4.3-4.5	4/72-10/72[6]
Ammonia (NH_4) AS/N mg/l	0.32-9.6	11/71-6/72[1]			4.1	11/4/71[6]
Boron mg/l	0.3	n.d.[3]			0.70	n.d.[3]
Chloride mg/l	80	n.d.[3]			372	n.d.[3]
Sulfate mg/l	64	n.d.[3]			304	n.d.[3]
Sodium mg/l	74	n.d.[3]			312	n.d.[3]
Total Coliforms MPN/100 ml	20-700,000	1941-1971[2]	2,400	5/71[5]	1,950	5/71[5]

* Sampling locations are shown on Figure

** Sources:
[1] U. S. Geological Survey, 1972.
[2] U. S. Bureau of Reclamation, 1974.
[3] Yoder-Trotter-Orlob & Associates, 1973.
[4] Northern Salinas Valley Mosquito Abatement District, 1975.
[5] California State Department of Public Health, 1972.
[6] California Department of Water Resources, pers. comm.

Table E-2

PESTICIDES IN LOWER SALINAS RIVER IN PARTS PER TRILLION (ppt)

Location	Date of Sample	DDT	Dieldrin	Diazinon	Parathion	Dacthal
Salinas River at Highway 1	11/4/71	80	32			160
	5/23/72		1,600		25	100
	8/22/72		230		40	520
Salinas River at Blanco Drain	11/4/71		60			390
Salinas River at Blanco Road	11/4/71	440				360
	8/22/72		700		110	3,600
Salinas River at Davis Road	11/4/71	150				340
	8/22/72				1,000	7,000
Salinas River at Gonzales	4/25/72		10	45	55	
	8/23/72		10			10

Source: California Department of Water Resources, 1973.

Table E-3

ELKHORN SLOUGH WATER QUALITY - 1975

	Highway 1*		Kirby Park*			Carneros Slough Inlet*				
	Aug	Sep	Jun	Jul	Aug	Sep	Jun	Jul	Aug	Sep
Temperature, °C	16	15	18	21	18	20	21	22	19	18.5
Turbidity, ppm formazin	1	2	31	27	15	8	34	13	35	20
pH	7.8	8.0	6.65	7.5	7.5	7.7	6.65	7.5	7.4	7.6
Dissolved Oxygen, ppm O_2	6.8	7.9	7.0	5.8	4.6	5.4	9.2	4.5	6.6	4.6
5-Day BOD, ppm O_2	6.2	3.9	--	4.6	6.1	2.9	--	3.7	4.5	2.9
Orthophosphate P, ppm P	0.09	0.23	0	0.13	0.02	0.37	0	0.20	0.05	0.11
Ammonia-Nitrogen, ppm N	0.05	0.16	0.76	0.06	0.5	0.08	0.15	0.25	0.17	0.03
Nitrate-Nitrogen, ppm N	0.22	0.08	--	0.38	0.20	0.07	--	0.30	0.13	0.09

* See Figure for location of sampling stations.

Source: Northern Salinas Valley Mosquito Abatement District, 1975.

Table E-4

WATER QUALITY DATA -- MAIN RECLAMATION DITCH

Location	TDS mg/l	Cl mg/l	Phosphate mg/l	Nitrate mg/l	Fecal Coliform MPN/100 ml	Total Pesticides ppt*	Malathion ppt	Diazinon ppt	Heptachlor ppt
Airport Boulevard[1] (east of Salinas)	360-377	91-100	1-4	15-59	230-62,000	4,790	1,480	650	60
Borondo Road[1] (1/2 mile west of Salinas)	497-966	131-190	2.8-5.8	33-48	—	7,930	140	480	50
San Jon Road[2] (3.4 miles southwest of Salinas)	362-1,042	62-262	—	—	—	—	—	—	—
Espinoza Road[1] (12 miles west of Salinas)	575-834	138-165	3.3-3.8	12-45	—	>3,690	110	400	40

[1] Recorded in May 1971 by California State Department of Public Health, 1971.

[2] Recorded on various dates, 1969-71, by Monterey County Flood Control and Water Conservation District, n.d.

Table E-5

WATER QUALITY -- OLD SALINAS RIVER ABOVE TEMBLADERO SLOUGH

Date	DO mg/l	Temp. °F	pH	EC mmhos/cm	NO_3 mg/l	B mg/l	BOD mg/l	COD mg/l	TOTP mg/l	Cad. mg/l	Pb mg/l	Merc. mg/l
4/25/72	15.3	72	8.5	2,090	1.1	0.50	24	60	1.4	0.00	0.00	0.0001
5/23/72	7.6	61	8.9	3,390	0.13	1.00	—	—	—	0.00	0.01	0.0001
8/23/72	6.5	70	8.7	2,990	0.9	0.80	—	—	—	0.00	0.00	0.000
10/25/72	13.7	—	8.4	2,500	2.8	0.80	—	—	—	0.00	0.00	0.000

Source: California Department of Water Resources, 1973 and 1974; sampling location shown in Figure .

LEGEND TO ABBREVIATIONS:

NO_3	Nitrate
B	Boron
COB	Chemical oxygen demand
TOTP	Total phosphorous
Cad.	Cadmium
Pb	Lead
Merc.	Mercury

For other definitions, see Water Resources glossary in text.

Table E-6

Sanitary Engineering Field Study of Monterey Bay
February 2-13, 1970
Certain Bacteriological Data Compared: August 1969 study vs February 1970 study

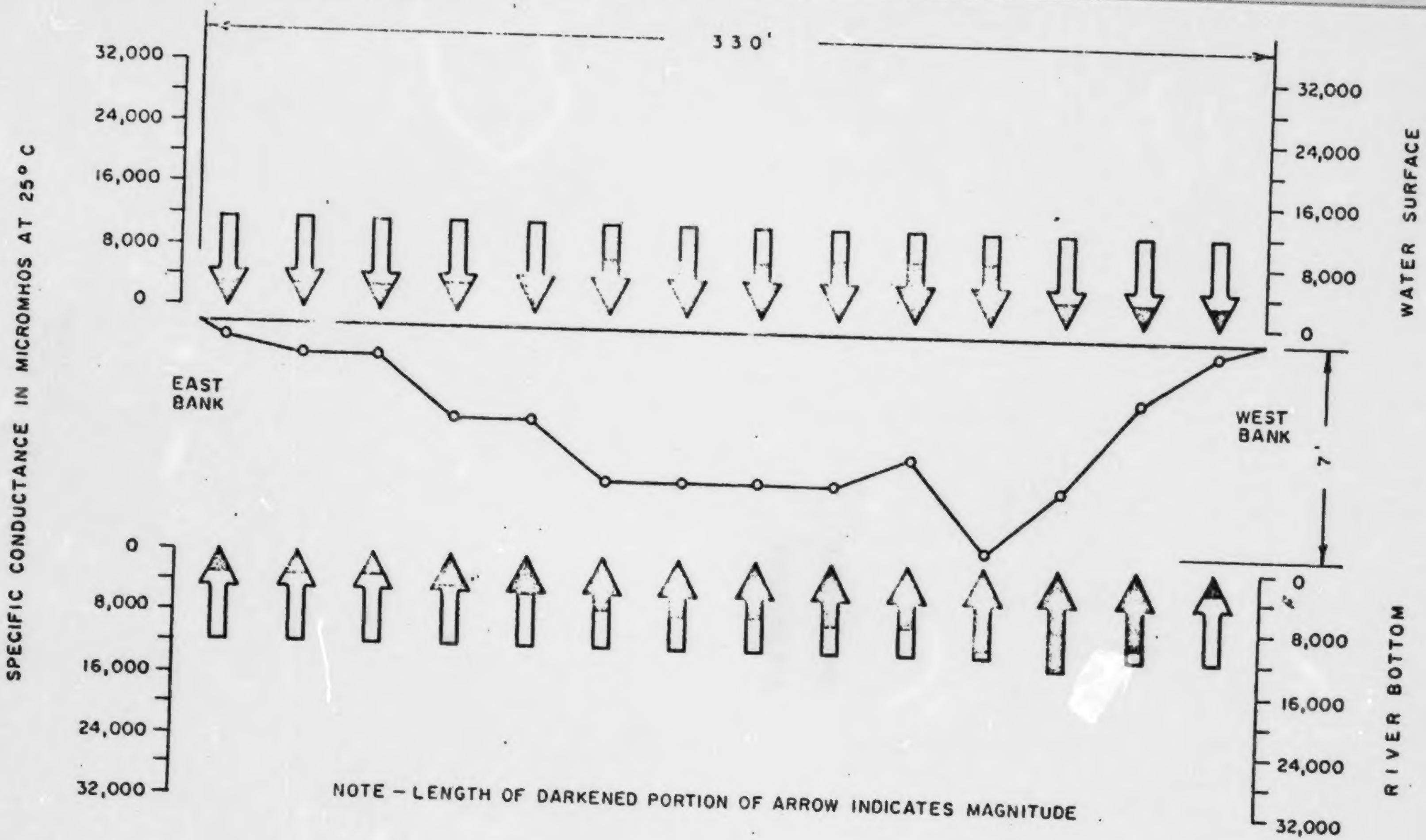
Sampling stations in the vicinity of:		August 1969 study coliform MPN per 100 ml.			February 1970 study coliform MPN per 100 ml.		
		Max.	Min.	Median	Max.	Min.	Median
Santa Cruz:	Beach	≥ 24,000*	40	90	≥ 24,000	<30	430
	offshore	150	<30	40	11,000	<30	90
East Cliff:	Beach	2,400	<30	40	≥ 24,000	<30	90
	offshore	11,000	<30	40	4,600	<30	40
Aptos :	Beach	430	<30	<30	4,600	<30	150
	offshore	90	<30	<30	430	<30	90
Watsonville:	Beach	230	<30	<30	11,000	<30	150
	offshore	430	<30	<30	≥ 24,000	<30	90
Seaside :	Beach	11,000	30	210	2,400	<30	90
	offshore	≥ 24,000	930	4,600	2,400	<30	40
Monterey :	Beach	≥ 24,000	<30	40	11,000	<30	40
	offshore	≥ 24,000	11,000	≥ 24,000	≥ 24,000	<30	90
Pacific Grove:	Beach	(1) 24,000	<30	230	(2) 230	<30	40
	offshore	24,000	<30	230	230	<30	<30
Carmel :	Beach	2,400	<30	90	≥ 24,000	<30	<30
	offshore	≥ 24,000	<30	150	150	<30	<30

(1) County Health Department Data.

(2) Lovers Point to Government Pier.

Source: Monterey County Health Department, et.al., 1970.

* SWRCB Ocean Waters of California coliform standard for nearshore areas is 1,000 MPN/100 ml; RWQCB shellfish area standard is 70 MPN/100 ml.



NOTE – LENGTH OF DARKENED PORTION OF ARROW INDICATES MAGNITUDE

Figure E-1. SPECIFIC CONDUCTANCE CROSS-SECTION
STATION 7 LOWER SALINAS RIVER*
DEC 9 1964

* Monitoring location #3 in Figure 6.

Source: California Department of Water Resources, 1965.

APPENDIX F

ARCHEOLOGY

APPENDIX F

MONTEREY PENINSULA REGIONAL WASTEWATER TREATMENT SYSTEM EXPANSION PROJECT

by

Tony F. Weber

and

Ann S. Peak

for

Ann S. Peak & Associates
Consulting Archeology

ANN S. PEAK & ASSOCIATES
CONSULTING ARCHEOLOGY

January 19, 1976

Jones & Stokes Associates
455 Capitol Mall
Sacramento, California

Gentlemen:

We are pleased to enclose herewith the final report on the Cultural Resource Assessment of the Monterey Peninsula Wastewater Treatment System Expansion Project.

The Antiquity Permit secured from the office of the Federal Secretary of the Interior, Washington, D.C., is included in the appendixes to the report, as is a letter to the History Preservation Section, California State Department of Parks and Recreation.

The report details survey results, field techniques, potential impact on archeological sites, and recommendations for mitigation.

It is believed that the report will be satisfactory in meeting local, state, and federal requirements having to do with identification and preservation of these nonrenewable environmental resources.

As required by the Secretary of the Interior's office, six copies of the report have been submitted to Washington, D.C., and copies of the site survey form have been sent to the Bureau of Land Management office, Bakersfield, California.

Sincerely,

Ann S. Peak

Ann S. Peak

AP:CL

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PLATES

MAPS 2-6

INTRODUCTION

The proposed project is the updating and improvement of the existing wastewater treatment systems of the Monterey Peninsula. The project includes expansion of existing plants, possible construction of new plants, and installation of intercepts and outfall lines.

Most of the project area lies in unstable dune areas or in older stabilized sand dunes east of the Bay. Vegetation varies from plant communities associated with the coastal area, riparian areas along the Salinas River, and rolling grasslands.

CULTURAL HISTORY

Indian

The Rumsen dialectic branch of the Costanoan people, part of the Penutian language family, occupied the area at the time of Spanish intrusion. The Costanoan territory extended from San Francisco Bay to near Point Sur. The inland boundaries are not precisely known because of lack of ethnographic data but are asserted or loosely assumed to be formed by the San Joaquin River, but far more probably the interior chain of the coast mountains, the Mount Diablo Range. The inland boundary problem is due primarily to early population displacement caused by Spanish missionization.

Although the settlement pattern of the Indian is only partially understood, it is known that major villages were usually located on bays near reliable sources of fresh water. Smaller ancillary villages and camps, presumably used for economic resource exploitation during the seasonal gathering cycles, are found along the coast and inland.

Economic subsistence along the coast naturally had a marine base--i.e., shellfish, fish, sea mammal, etc.--with augmentation of the diet through gathering of seeds and other vegetable foods. Where oaks were found, the acorn formed the primary plant food source (Kroeber 1925:467). Mammals and birds were hunted to further increase the diet base.

The Costonoan people were among the first Indian groups to be displaced by the missionization efforts of the Spanish. The cultural traditions of the natives were replaced by the new and unfamiliar ways of the explorers and mission fathers. Decimation of the Indian neophytes by disease further destroyed the old life-ways. Following secularization of the missions after the Mexican War of Independence, the mission lands were granted to settlers and the Indian residents dispersed. A few returned to their ancestral villages, but most remained near the old missions.

Previous archeological surveys near Monterey have recorded numerous prehistoric villages and campsites. The concentration of these lies predominantly along the coast southwards from the city. No sites are known to be situated on the coast northwards from Monterey toward the cities of Seaside and Marina. The density of sites suggests intensive aboriginal use and the depth of the cultural deposits indicates a long temporal span of occupation.

Spanish

Monterey Bay was first reached by a Portuguese navigator sailing under the Spanish flag. Don Juan Rodríguez Cabrillo set sail from Mexico, arriving in California waters in 1542. He entered Monterey Bay at Punta Piños, the present site of the city of Monterey. Heavy surf kept Cabrillo offshore and he never landed, but proceeded to explore as far as the Oregon coast.

In 1602, Sebastián Vizcaino, looking to find suitable harbor for ships of the Manila Galleon, left Mexico with three priests and a complement of men. The expedition spent two weeks surveying and mapping Monterey Bay and the surrounding area.

Costly wars and internal strife quelled Spain's interest in the New World for the following 150 years. However, Charles III became aware that the Russian fur traders were threatening encroachment on Spanish California. Gaspar de Portolá was commissioned to establish missions and presidios in Alta California.

In 1770, Portolá and Father Junipero Serra claimed the area for Charles III of Spain and the foundation for missions and presidios in Alta California had been laid. Father Serra moved the original mission San Carlos Borromeo from the presidio to the Carmel River. Serra's primary objectives were to Christianize the Indians and train them in the simple arts of civilization.

Juan Bautista de Anza led a land expedition from Mexico to Monterey, blazing a trail which colonists could travel overland to Monterey. Shortly, women and families began to arrive and Monterey began to look like a settlement.

In the following year, Monterey was named the capital of California. It lies at the center of the chain of missions which Father Serra had established from San Diego to San Francisco; therefore, it became the religious capital of California also.

In the period from 1782 to 1810, many of the colonists and military men were given large land grants. Monterey became quite self-sufficient, and somewhat isolated, during this time. No new colonists were arriving, due to the Yuman Indians cutting off de Anza's trail and Spain's not having the time or money to provision the small colony. In 1810, during Spain's South American revolution, Monterey was sacked by two Argentinian men-of-war, taking many months to rebuild.

After the Mexican war of independence, the capital was moved to Loreta.

American

In 1846 the United States acquired California from Mexico after its victory in the Mexican-American War. However, in October, 1842, Commodore Thomas Jones of the United States Navy sailed into Monterey Bay. He was under the impression that Mexico and the United States were at war, so he seized the port. After discovering that the war had not yet begun, he set out to undo his mistake by first lowering the American flag and then replacing it with the Mexican one. As he was sailing away, he fired a salute of apology.

At the outbreak of the Mexican-American War, Commodore John Sloat seized Monterey. He set anchor on July 2, 1846, landed his troops, and raised the American flag, encountering no resistance from the presidio. Commodore Sloat was later replaced by Robert Stockton, who appointed Walter Colton to act as the *alcalde*. After the shock of the invasion dimmed, the people of Monterey accepted the Americans, opening their doors to the new business.

After the seizure, the people of Monterey enjoyed peace and prosperity while the struggle for California was waged in the south. The surrender at Cahuenga on January 13, 1847, ended organized resistance to the American occupation, but it was not until another year that the peace treaty was signed and California became the property of the United States.

Nine days before signing of the Guadalupe Hidalgo Treaty, ending the Mexican-American War, gold was discovered in the foothills of the Sierra Nevada Mountains. Seemingly overnight, people from all over California were rushing to the gold fields. Monterey became a town of women, children, and others unable to make the trip to the mountains.

Now that California was a territory of the United States, much discussion centered around the need for a constitutional convention. Miners improvised their own government and therefore lacked tolerance for any other form. This led to much chaos and the need for a uniform government. Finally, in 1849, Bennett Riley, the new governor of California, issued a call for a constitutional convention.

The convention began in September, 1849, and was held in Monterey at Colton Hall. Forty-eight delegates, 10 from the southern district and 38 from the northern, met to form a constitution, with Robert Semple serving as president. Most of the delegates were Americans, with a handful of Californians. The principal issue of the convention concerned whether California would be a state or a territory. By a great majority, the delegates voted to form a state. In considering the question of slavery, the delegation decided that California would join the union as a free state. William Gwin and John Fremont were elected to represent California in the United States Senate.

After the convention, Monterey lost all of its prestige to San Francisco and San Jose. San Francisco, being much closer to the gold country, became a popular port and the center of business. With the advent of statehood, San Jose replaced Monterey as the political capital of California.

In the 1850s and 1860s, whaling became the major industry in Monterey. Then, in the 1900s, sarding fishing replaced whaling as the primary industry. By 1920, Monterey was the third largest fish tonnage port in the world, but by 1940 the catch began to decrease, thus forcing many of the companies out of business.

The new, quiet atmosphere of the town attracted artists, painters, and writers. Robert Louis Stevenson spent some time in Monterey and was there inspired to write his novel, Treasure Island. Other artists such as Charles Warren

Stoddard, Jules Tavernier, Joseph Strong, Julia Rix, and violinist Henry Heyman found the calm, tranquil town much to their liking.

Today Monterey houses much of California's heritage. People come from all over to see the mission in Carmel or the presidio six miles away. Many people enjoy wandering along Cannery Row, reliving the episodes of the old fishermen or the tales of John Steinbeck. Others enjoy the recreational centers which can be found throughout the peninsula. Still others travel the Seventeen Mile Route along the ocean, which encompasses some of the most beautiful sites one can imagine.

RESEARCH

Files and records of identified archeological sites were reviewed at the Cultural Resource Section, California Department of Parks and Recreation, and historical records were consulted at the History Preservation Section in that same agency.

A letter was requested from the California Department of Parks and Recreation concerning cultural resources (Appendix 2).

There were no identified archeological sites within the boundaries of the impact zones of the proposed project. Historical aspects of the region are well documented, although no historical features are noted in impact areas.

FIELD ASSESSMENT

All alternative alignments, treatment plant site alternatives, and existing plant sites (Maps 1-6) were traversed on foot by the two-person team of experienced archeologists. All ground surfaces were carefully examined for evidence of historic and prehistoric occupation/use. Where further definition was felt to be required, small trowel holes were dug to maximum depths of 25 centimeters (cm).

Where cultural evidence was found, these locations were plotted on the appropriate U.S.G.S. 7.5' topographic maps (Map 1) and a site survey form completed which detailed critical data on artifacts, extent of site, and its location (Appendix 3).

Lands under jurisdiction of the federal government (Fort Ord and the Naval Postgraduate School) required an Antiquity Permit to allow access (Appendix 1). Permission to enter was obtained from the proper authorities prior to actual field survey.

FIELD ASSESSMENT RESULTS

With one exception, there was no surface evidence of prehistoric sites within treatment plant sites or alternatives or along alternative routes. One probable prehistoric site (MS-MP-1) was located within the boundaries of the proposed Seaside Treatment Plant expansion (Map 1, Appendix 3).

The area of the site covers about 30 meters by 30 meters and is located on the western slopes of a small sand dune. Evidence of prehistoric habitation is sparse but there is sufficient content to consider it as a site.

Cultural material includes chert flakes, retouched flake scrapers, an obsidian flake, thermal fractured rock (broken cooking stone), shell fragments, and mammal bone fragments.

CONCLUSIONS

The presence of site JS-MP-1 is probably related to the available water source contained by the fresh water lagoons immediately south of the site location. Other sites may be present, but the unstable sand dunes of the survey area have perhaps concealed any surface evidence of prehistoric occupation.

The lack of sites in areas adjacent to the Salinas River on the secondary terraces cannot be explained. It may be that these areas were subject to periodic overflow of the river and were considered unstable by the Indian population.

MITIGATION

The area of JS-MP-1 (Map 1) should have further testing to allow an evaluation of significance of the site. It is strongly recommended that a minimum of three 1 x 2 meter units be excavated by a professional archeological firm. The analysis of recovered data will permit an evaluation of the site and allow the archeologist to develop specific recommendations concerning further disposition of the site.

Although no sites were identified in other areas of the project, much of the land is covered by active or older, stabilized sand dunes. The dunes may have buried other archeological sites, leaving no surface evidence of their location. It is recommended that construction be halted and a qualified archeologist be consulted for advice should unusual amounts of shell, bone, stone, or artifacts be uncovered during construction activities.

GROWTH INDUCEMENT

Should the construction of the project induce further urban growth, additional cultural resource assessments should be required by jurisdictional agencies as each land parcel is considered for development.

ADDENDUM

A second survey was initiated when four additional alternative outfall lines were considered. The alignments were traversed on foot by the archeologist, using the same techniques as the original survey. The alignments are delineated on Maps 3 and 6 and denoted 1 through 4.

Impacts

No cultural evidence was observed within the impact areas of the four new alternatives. However, as noted in the original report (page 8), sites may be buried beneath the unstable sand dunes, leaving no surface evidence.

Mitigation

Should unusual amounts of stone, shell, or bone be uncovered during construction, work should be halted and an archeologist retained to evaluate the situation.

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APPENDIX 1

Antiquity Permit

Form 10-71
(July 1971)

UNITED STATES DEPARTMENT OF THE INTERIOR

Please use this number when referring to this permit.

NO. 75-CA-111

ANTIQUITIES ACT PERMIT

To Conduct Work Upon Lands Owned or Controlled by the United States Under the Act For The Preservation of American Antiquities

(Approved June 8, 1906 (34 Stat. 225, 16 U.S.C. 432, 433) and the Regulations Thereunder)

1. PERMIT ISSUED TO:
California State University/Sacramento, California

DATE:
December 11, 1975

2. NAME, ADDRESS AND OFFICIAL STATUS OF PERSON:

a. In general charge:

Dr. Jerald J. Johnson
Department of Anthropology
California State University
Sacramento, California 95819

b. In actual direct charge:

Ann S. Peak
(address same as above)

3. UNDER APPLICATION DATED:
June 12, 1975

4. AUTHORIZES:
Archeological Investigations (Survey Only)

5. ON LANDS DESCRIBED AS FOLLOWS:
Department of Defense lands administered by the Department of the Army in the State of California: Fort Ord including sectors under controlled by the Department of the Navy (Naval Postgraduate School).

6. FOR PERIOD:
December 11, 1975 through January 10, 1976 (one month)

7. MATERIALS COLLECTED UNDER THIS PERMIT WILL BE DEPOSITED FOR PERMANENT PRESERVATION IN THE

California State University (Department of Anthropology)
Sacramento, California

OR IN OTHER ACCREDITED INSTITUTIONS UNDER SUITABLE LOAN AGREEMENTS.

8. SPECIAL CONDITIONS

This permit is subject to the provisions of the Act for the Preservation of American Antiquities approved June 8, 1906, and the interdepartmental regulations including 25 CFR 132, as to Indian lands, promulgated thereunder (copies attached), as well as the special conditions on the reverse of this form.

9. PRELIMINARY REPORT

Within approximately 6 weeks of the conclusion of field work, a preliminary report of work performed under this permit, illustrated with representative photographs and listing new and significant collected materials should be furnished the Secretary, Smithsonian Institution, and 6 copy(s) thereof should be forwarded to this Department.

DEPARTMENTAL CONSULTING ARCHEOLOGIST (Signature)

fr Rex L. Wilson

/s/ Charles M. McKinney

8. (CONTINUED) SPECIAL CONDITIONS ARE CHECKED (X) AS APPROPRIATE TO THIS PERMIT

a. ☒ This permit shall not be exclusive in character, and there is hereby reserved unto the landowners the right to use, lease or permit the use of said land or any part thereof for any purpose.

b. ☒ Other institutions may be engaged in archeological research in the general area covered by this permit, and in case there should be conflict with respect to a site not specifically designated in a permit, the parties concerned shall reach agreement between themselves as to which shall work the site.

c. ☒ The Department of the Interior, including its bureaus and employees and the landowners and their grantees, shall be held blameless for any and all events, deeds or mishaps, regardless of whether or not they arise from operations under this permit.

d. ☒ Such guidance and protection as is consistent with the duties of the Department of the Army/Navy ~~Interior~~ official in charge of the area will be afforded the permit holder and his party.

e. ☒ Transportation in Department of the Interior vehicles cannot be furnished, except in cases where no extra expense to the Department is involved.

f. ☒ All costs shall be borne by the permittee.

g. ☒ The exploration or excavation of any Indian grave or burial ground on Indian lands and reservations under the jurisdiction of the Department of the Interior is restricted solely to qualified archeologists. No grave or burial ground abandoned less than 200 years may be investigated without permission of the governing council of the Indians concerned, which supplemental authority must be promptly recorded with the superintendent or other official in charge of the designated area.

h. ☐ All excavated areas shall be restored by filling in the excavations and otherwise leaving the area in as near to original condition as is practicable.

i. ☒ The permittee shall conduct all operations in such a manner as to prevent the erosion of the land, pollution of the water resources, and damage to the watershed, and to do all things necessary to prevent or reduce to the fullest extent the scarring of the lands.

j. ☒ Any findings of mined or processed precious metals or other treasure or treasure trove in the area covered by this permit are the exclusive property of the landowners, and shall not be disturbed or removed from the site without specific written permission from the Department of the XXXXXX. Army.

k. ☐ Before undertaking any work on lands administered by the Bureau of Land Management, clearance should be obtained from the Office of the State Director at ____________________, and from the BLM District Officer in direct charge of the area concerned at ____________________.

l. ☐ Before undertaking any work on lands administered by the Fish and Wildlife Service, clearance should be obtained from the Office of the Regional Director at ____________________, and the Refuge Manager in charge at ____________________. Possession or use of firearms in such areas is prohibited.

m. ☐ Before undertaking any work on lands administered by the Bureau of Reclamation, clearance should be obtained from the official in charge of the area.

n. ☐ Before undertaking any work on lands administered by the National Park Service, clearance should be obtained from the superintendent in charge of the area.

o. ☐ Before undertaking any work on Indian tribal lands or on individually owned trust or restricted Indian lands, clearance should be obtained from the Bureau of Indian Affairs official having immediate jurisdiction over the property at ____________________

☒ Other special conditions continued on attached sheet(s).

APPENDIX 2

Communication with California Department of Parks and Recreation

ANN S. PEAK & ASSOCIATES
CONSULTING ARCHEOLOGY

October 15, 1975

Dr. Knox Mellin, Supervisor
History Preservation Section
Department of Parks and Recreation
P.O. Box 2290
Sacramento, California 95811

Dear Dr. Mellin:

As consultant to Jones & Stokes Associates, 455 Capitol Mall, Suite 835, Sacramento, California 95814, I wish to request information from your office on the cultural resources within the impact zones of the proposed Monterey Regional Wastewater Treatment System Project. Maps defining the proposed treatment plant sites and possible interceptor routes are enclosed for your information.

A recent field investigation found that there were no historic features within the impact areas. One possible prehistoric site was located within the boundaries of the proposed Seaside Treatment Plant site (Map 1). It has been recommended that test units be excavated here to allow evaluation of the site. There were no other sites previously recorded within the recent survey areas.

Sincerely,

Tony F. Weber
Consulting Archeologist

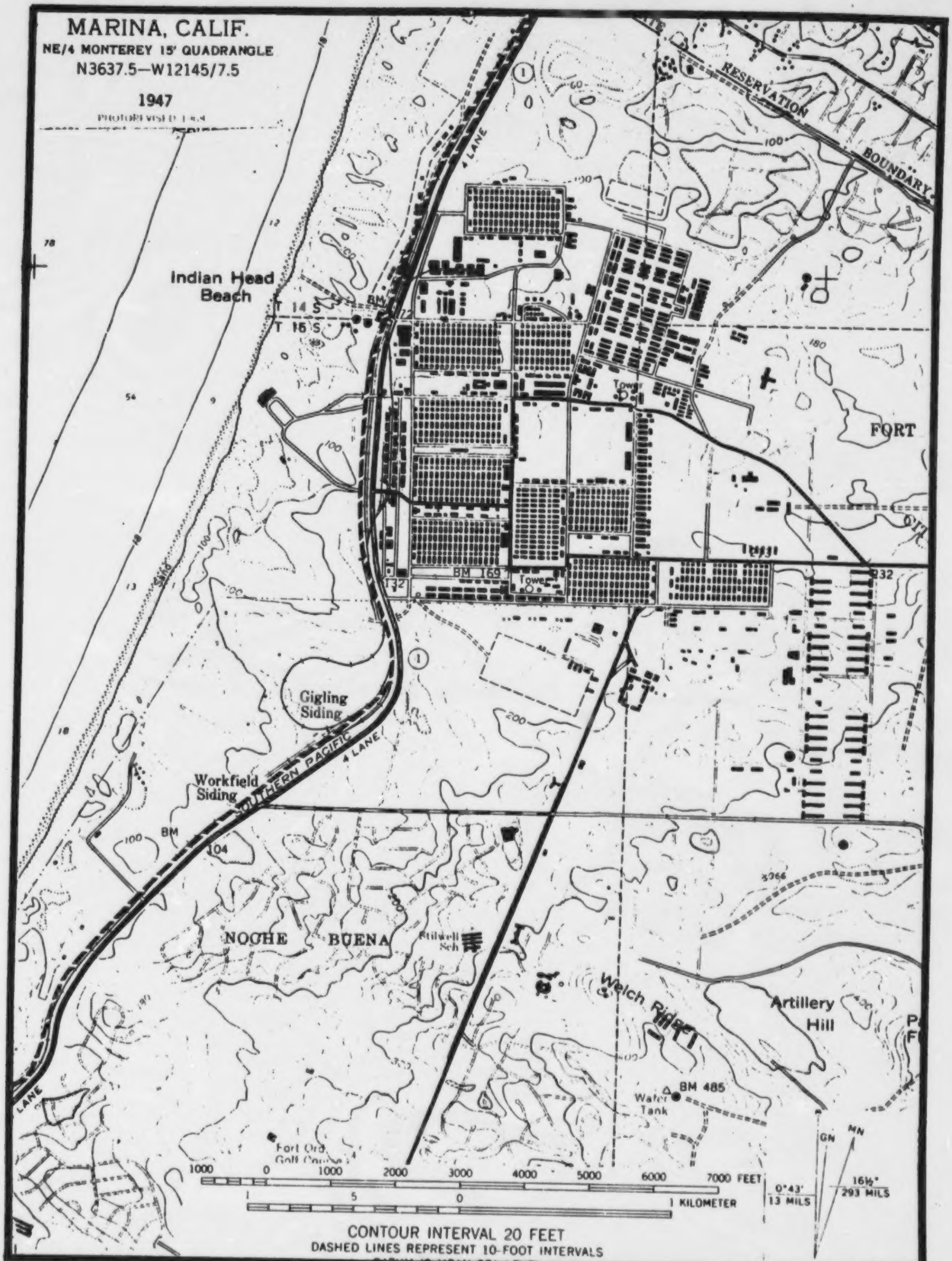
TW:CL
Encl.: Maps

8332 [illegible] WAY - FAIR OAKS - CALIFORNIA - 95628 - (916) 967-3684

MAPS 2-6

▨ = Areas of survey

- - - - - - - - = Alignments and alternative surveys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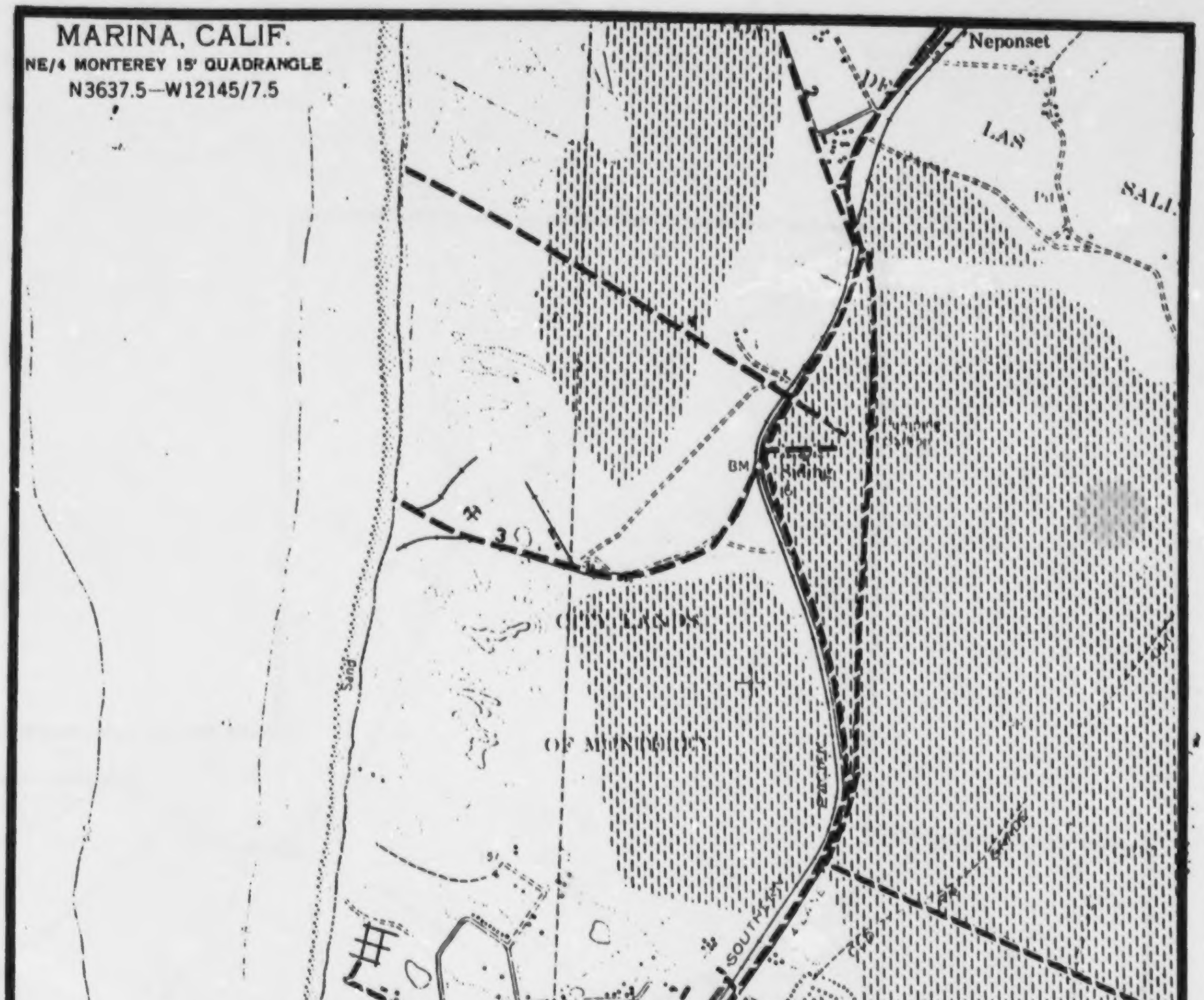
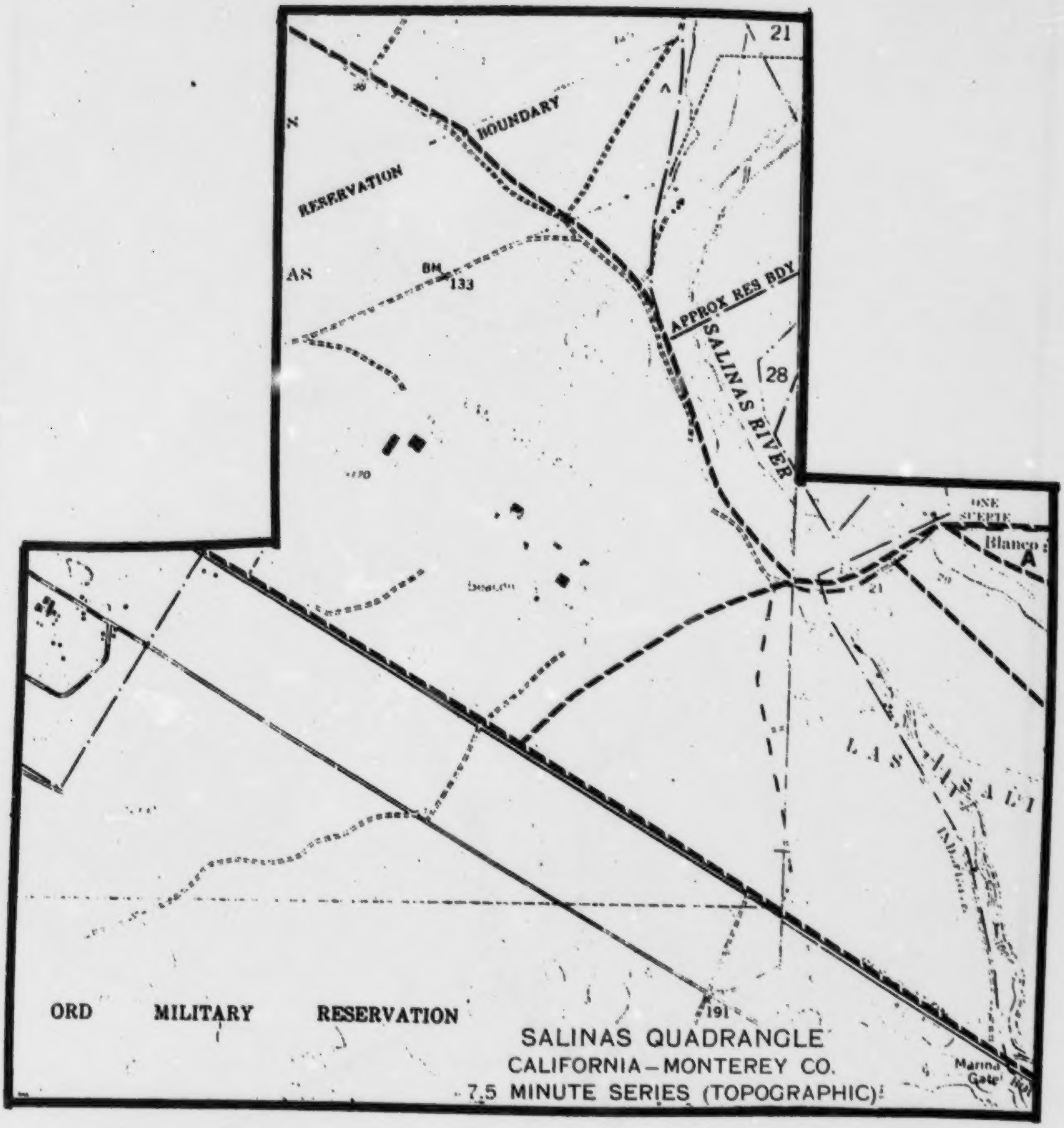
NE/4 MONTEREY 15' QUADRANGLE
N3637.5—W12145/7.5
1947
Indian Head Beach
T 14 S
T 15 S
BM 72
4 LANE
RESERVATION BOUNDARY
FORT
Tower
BM 169
232
132
Gigling Siding
Workfield Siding
SOUTHERN PACIFIC
BM 104
NOCHE BUENA
Stilwell Sch
Welch Ridge
Artillery Hill
BM 485
Water Tank
Fort Ord Golf Course
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER
0°43' 13 MILS
16½° 293 MILS
GN
MN
CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 10-FOOT INTERVALS

' Published for civil use by the Geological Survey

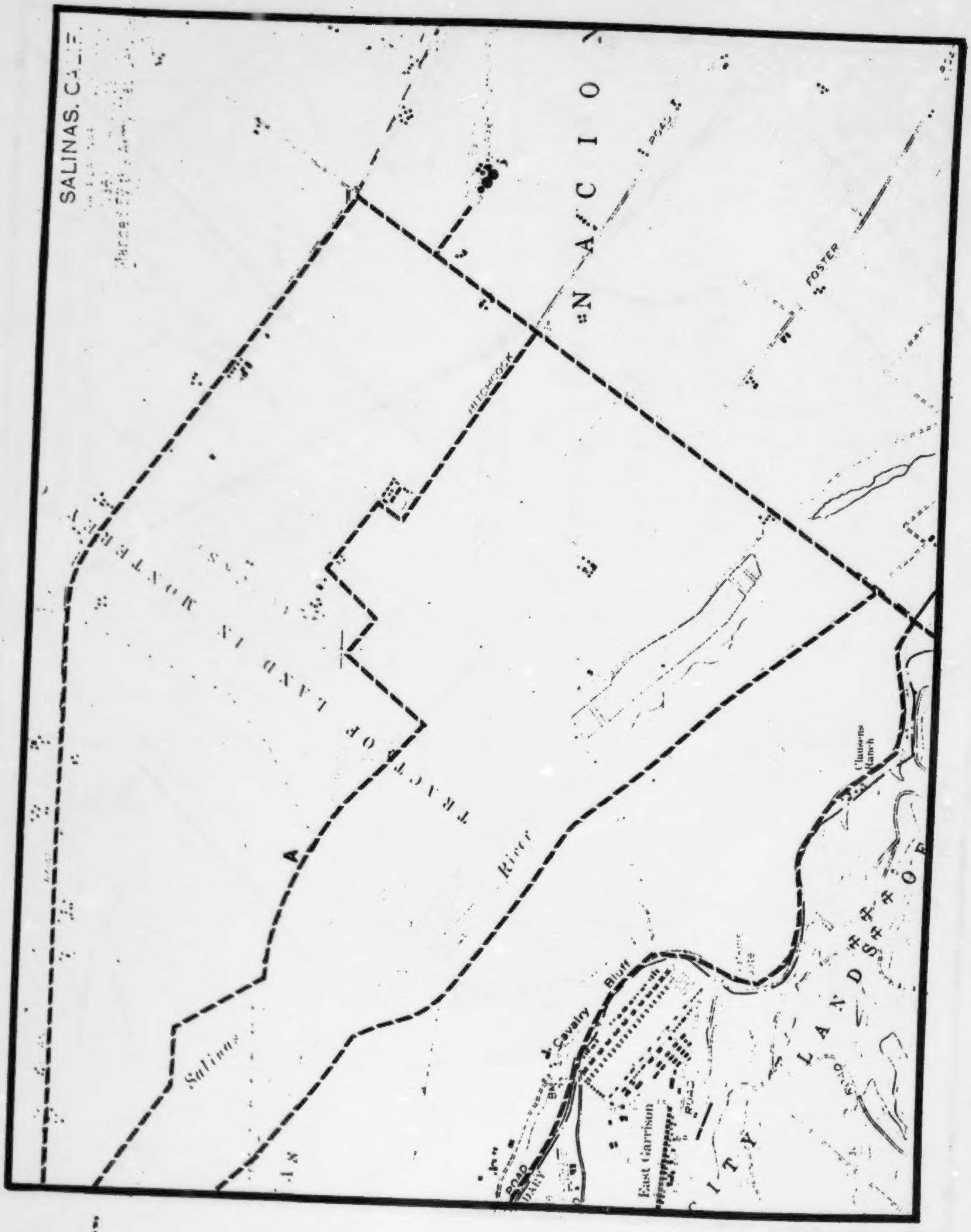
MAP 2


MARINA, CALIF.
NE/4 MONTEREY 15' QUADRANGLE
N3637.5—W12145/7.5
Neponset
DE
LAS
SALI
Sand
BM
3
CITY LANDS
OF MONTEREY
SOUTHERN
BM 144
Marina
APPROXIMATE
SALI
APPROX
60

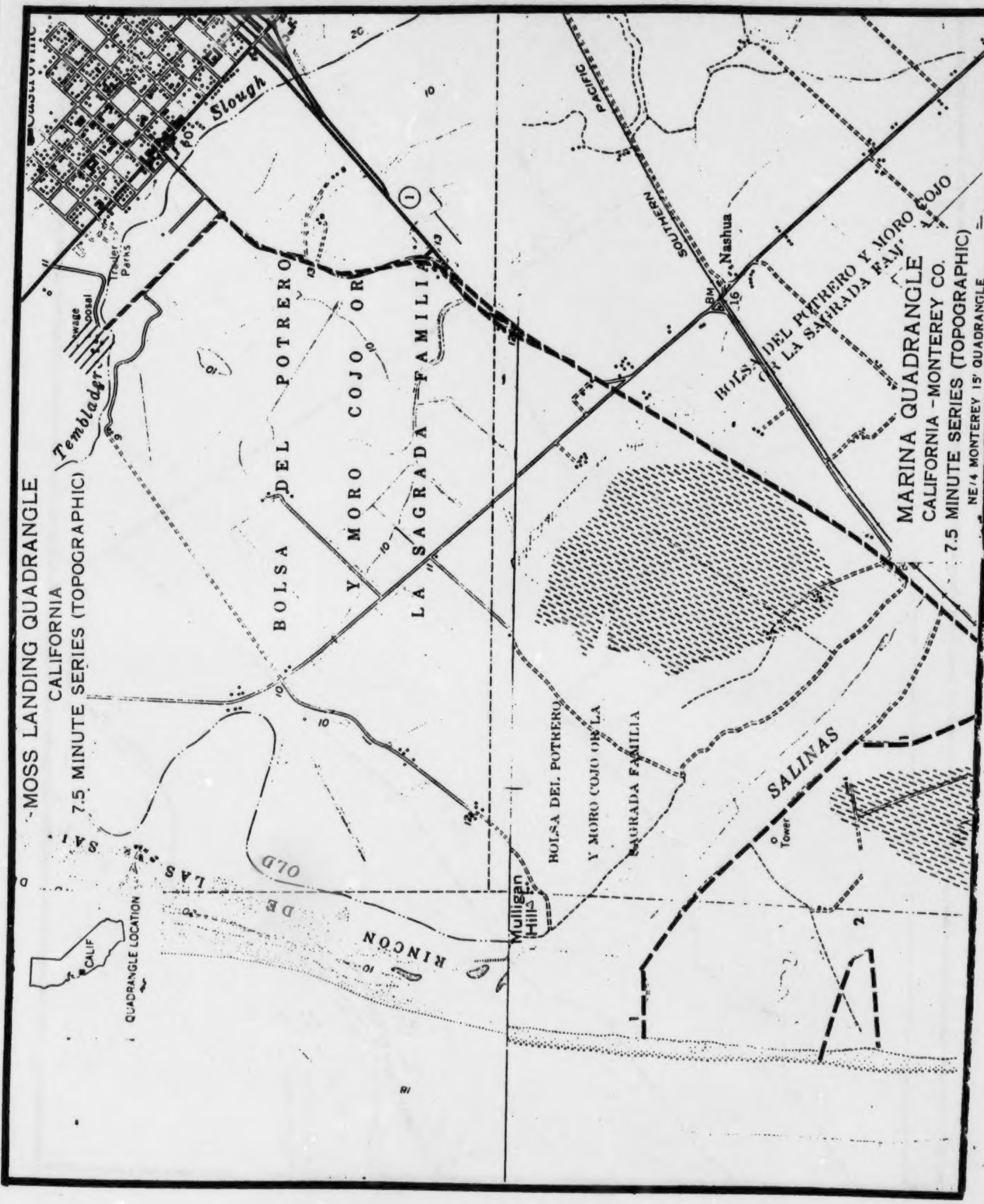
MAP 3


21
BOUNDARY
RESERVATION
AS
BM
133
APPROX RES BDY
SALINAS RIVER
28
Blanco
A
21
LAS
ORD MILITARY RESERVATION
191
Marina Gate
SALINAS QUADRANGLE
CALIFORNIA – MONTEREY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

MAP 4


SALINAS, CALIF.
TRACT OF LAND IN MONTEREY
NACION
A
Salinas
River
HITCHCOCK
FOSTER
ROAD
Cavalry
Bluff
East Garrison
ROAD
DAIRY
Claussens Ranch
CITY LANDS OF

MAP 5


MOSS LANDING QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
MARINA QUADRANGLE
CALIFORNIA - MONTEREY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 MONTEREY 15' QUADRANGLE
BOLSA DEL POTRERO Y MORO COJO OR LA SAGRADA FAMILIA
BOLSA DEL POTRERO Y MORO COJO OR LA SAGRADA FAMILIA
BOLSA DEL POTRERO Y MORO COJO OR LA SAGRADA FAM.
Slough
Tembladero
Trailer Parks
Sewage Disposal
SOUTHERN PACIFIC
Nashua
BM 16
SALINAS
OLD
RINCON DE LAS SALINAS
Mulligan Hill
Tower
QUADRANGLE LOCATION
CALIF
1
2

MAP 6

ADDENDUM 1

CULTURAL RESOURCE ASSESSMENT OF THE INTERCEPTOR LINE -- EAST OF BLANCO ROAD AND WEST OF DAVIS ROAD.

(Augmentation of Monterey
Peninsula Regional Wastewater
Treatment System)

July 1, 1976

by

Ann S. Peak & Associates

INTRODUCTION

The present report covers the cultural resource assessment of an alternative interceptor line (See A on Maps 4 and 5 of original report). Location of the proposed Alternative Line is north of the Salinas River east of the Blanco Road Bridge and west of Davis Road on the 7.5' U.S.G.S. topographic map Salinas, California.

The Alternative Alignment Assessment report will be appended to the original report (Weber and Peak, 1976). As the previous work included a regional record research of cultural resources and a development of the cultural history, these sections will not be repeated in the Appendix.

FIELD ASSESSMENT AND RESULTS

The new Interceptor Alternative was traversed on foot by the two-person team of archeologists. The western extent of the alignment follows the existing Hitchcock Road and then continues southwesterly along dirt roads to terminate near the Salinas River crossing of Blanco Road. The entire land area adjoining Hitchcock Road and the dirt roads is under cultivation and this appears to be a condition of long-standing.

No evidence of archeological sites or historic features was observed within or adjacent to the potential impact zone.

IMPACT

There will be no impact on identified cultural resources. There is the possibility that the extensive conversion of the land for agriculture has obscured unknown archeological sites. These may be covered by culturally sterile soils and show no surface evidence of their existence. The construction procedures for installation of the pipelines might expose a buried site or sites and impact portions of the cultural deposit.

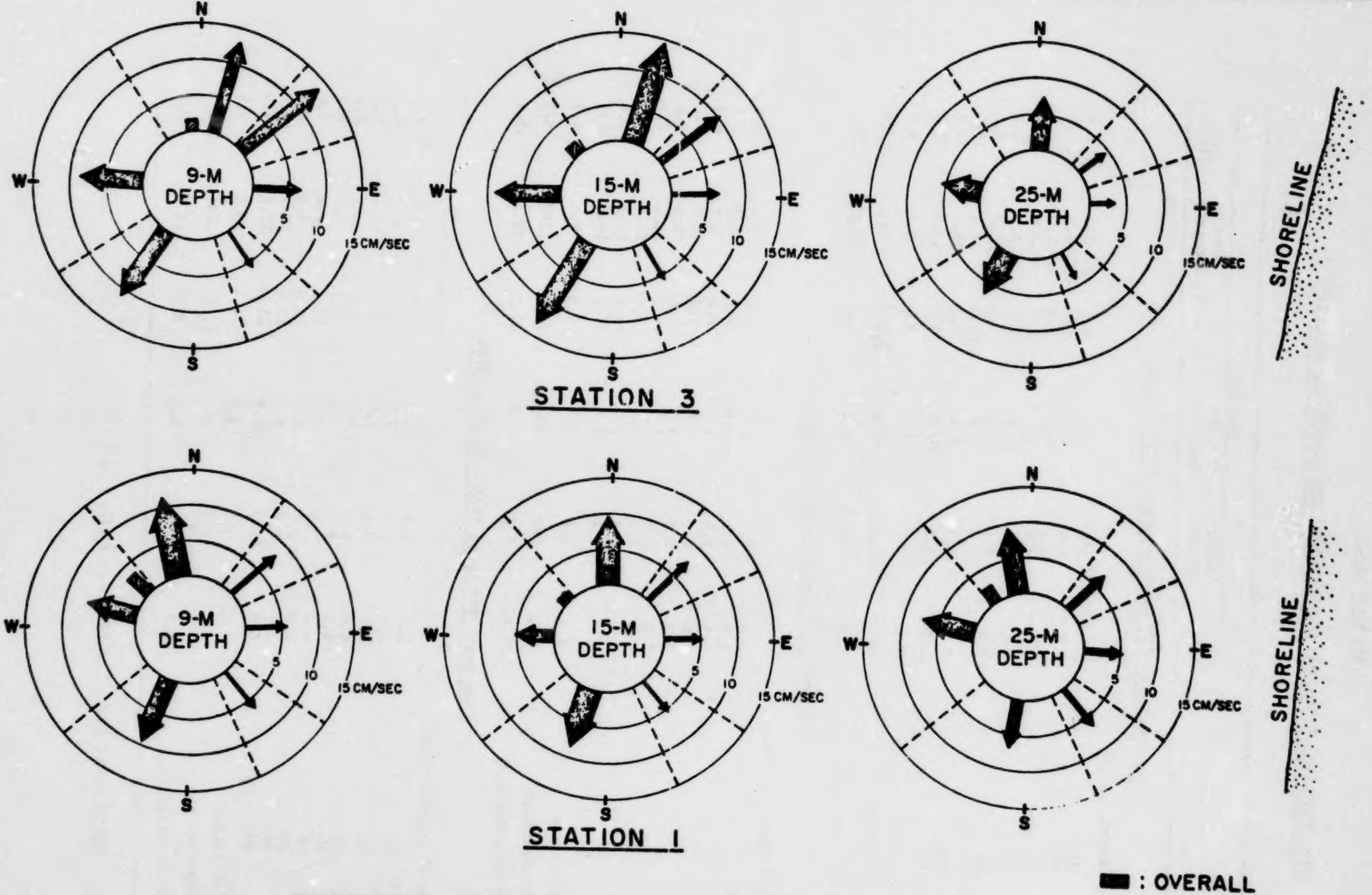
RECOMMENDATIONS

Should a buried site be exposed during construction, work should be halted and the archeologist retained to assess the situation and make specific recommendations for mitigation.

An archeological site might be identified by unusual amounts of sea shell, bone, stone tools, artifacts, or human bone.

APPENDIX G

MONTEREY BAY CURRENTS



CURRENT VECTOR RESULTANTS BY SECTOR

Figure G-1

Source: Engineering Science, Inc., 1976f.

Table G-1

STATISTICAL SUMMARY OF METERED CURRENTS AT STATION 1

Parameter	Sector					
	Onshore	Onshore Upcoast	Onshore Downcoast	Upcoast	Down-coast	Offshore
9-m Depth (20 January 1976 - 22 July 1976)						
Distribution of Speed, cm/sec						
Percentile: 10	2.4	2.9	3.1	4.4	3.3	2.2
20	3.6	4.8	4.2	6.9	5.6	4.2
30	4.5	6.1	5.1	8.8	7.3	5.7
40	5.3	7.3	5.8	10.3	8.8	6.9
50	6.0	8.3	6.5	11.8	10.1	8.1
60	6.7	9.4	7.2	13.3	11.4	9.2
70	7.5	10.5	7.9	14.8	12.8	10.4
80	8.4	11.9	8.8	16.7	14.5	11.9
90	9.6	13.7	10.0	19.2	16.9	13.9
Standard Deviation	2.8	4.2	2.7	5.8	5.3	4.6
Number of Observations	467	528	253	2,700	1,852	1,954
Frequency of Occurrence, %	6.0	6.8	3.3	34.8	23.9	25.2
15-m Depth (20 January 1976 - 19 April 1976)						
Distribution of Speed, cm/sec						
Percentile: 10	2.4	3.1	2.3	3.6	3.3	0.9
20	3.5	4.7	3.4	5.9	5.2	2.7
30	4.3	5.9	4.1	7.6	6.7	4.0
40	5.0	6.9	4.8	9.0	7.9	5.1
50	5.6	7.8	5.3	10.4	9.0	6.1
60	6.2	8.7	5.9	11.7	10.1	7.2
70	6.8	9.7	6.6	13.1	11.3	8.3
80	7.6	10.8	7.3	14.8	12.7	9.6
90	8.7	12.4	8.4	17.1	14.6	11.4
Standard Deviation	2.5	3.6	2.4	5.3	4.4	4.1
Number of Observations	240	280	152	1,139	1,147	679
Frequency of Occurrence, %	6.6	7.7	4.2	31.3	31.5	18.7
25-m Depth (19 April 1976 - 22 July 1976)						
Distribution of Speed, cm/sec						
Percentile: 10	2.1	2.5	2.3	3.9	2.4	2.6
20	3.3	4.0	3.8	5.9	4.2	4.5
30	4.1	5.1	4.8	7.4	5.4	6.0
40	4.8	6.0	5.7	8.6	6.5	7.2
50	5.5	6.9	6.5	9.7	7.4	8.3
60	6.2	7.8	7.4	10.8	8.4	9.4
70	6.9	8.7	8.3	12.0	9.5	10.6
80	7.7	9.8	9.3	13.5	10.7	12.0
90	8.9	11.3	10.8	15.5	12.4	14.0
Standard Deviation	2.7	3.5	3.3	4.5	3.9	4.5
Number of Observations	442	398	261	1,147	691	1,175
Frequency of Occurrence, %	10.7	9.7	6.3	27.9	16.8	28.6

Source: Engineering Science, Inc., 1976f.

Table G-2

STATISTICAL SUMMARY OF METERED CURRENTS AT STATION 3

Parameter	Sector					
	Onshore	Onshore Upcoast	Onshore Downcoast	Upcoast	Down-coast	Offshore
9-m Depth (20 January 1976 - 22 July 1976)						
Distribution of Speed, cm/sec						
Percentile: 10	0.8	3.4	1.3	1.8	2.2	1.4
20	3.0	7.0	3.0	6.1	5.5	4.2
30	4.5	9.6	4.2	9.2	7.8	6.3
40	5.8	11.8	5.2	11.8	9.8	8.0
50	7.0	13.9	6.2	14.3	11.6	9.6
60	8.2	15.9	7.1	16.7	13.4	11.2
70	9.5	18.2	8.1	19.3	15.4	13.0
80	11.0	20.8	9.3	22.5	17.7	15.0
90	13.1	24.4	11.0	26.7	21.0	17.9
Standard Deviation	4.8	8.2	3.8	9.7	7.3	6.4
Number of Observations	730	1,660	256	1,550	2,126	2,080
Frequency of Occurrence, %	8.7	19.8	3.0	18.4	25.3	24.8
15-m Depth (20 January 1976 - 19 April 1976)						
Distribution of Speed, cm/sec						
Percentile: 10	2.4	3.5	2.4	4.5	4.9	2.3
20	3.9	5.9	3.6	8.3	8.0	5.0
30	5.0	7.6	4.4	11.1	10.3	7.1
40	5.9	9.0	5.1	13.4	12.2	8.8
50	6.7	10.3	5.8	15.5	14.0	10.3
60	7.6	11.7	6.5	17.7	15.8	11.9
70	8.5	13.1	7.2	20.0	17.7	13.6
80	9.6	14.8	8.0	22.7	20.0	15.7
90	11.0	17.2	9.2	26.5	23.1	18.4
Standard Deviation	3.4	5.3	2.6	8.6	7.1	6.3
Number of Observations	272	432	153	1,314	1,253	872
Frequency of Occurrence, %	6.3	10.0	3.6	30.6	29.2	20.3
25-m Depth (19 April 1976 - 22 July 1976)						
Distribution of Speed, cm/sec						
Percentile: 10	0.0	0.0	0.0	0.0	0.0	0.0
20	0.7	0.5	1.1	0.7	1.5	1.0
30	1.8	2.1	2.3	3.5	3.6	3.0
40	2.8	3.4	3.3	5.8	5.3	4.6
50	3.7	4.6	4.2	8.0	6.9	6.1
60	4.6	5.9	5.1	10.2	8.5	7.6
70	5.5	7.2	6.1	12.5	10.2	9.2
80	6.7	8.8	7.3	15.3	12.2	11.1
90	8.3	10.9	8.9	19.1	15.0	13.8
Standard Deviation	3.6	4.9	3.7	8.7	6.4	6.0
Number of Observations	191	268	146	1,032	1,280	1,211
Frequency of Occurrence, %	4.6	6.6	3.5	25.0	31.0	29.3

Source: Engineering Science, Inc., 1976f.

BACKGROUND DATA -- BIOLOGICAL ENVIRONMENT

APPENDIX H

TERRESTRIAL BIOTA

Table H-1

SALINAS RIVER RIPARIAN PLANT SPECIES COMPOSITION

Common Name	Scientific Name
	Shrubs
Quail bush	*Atriplex lentiformis*
Allscale	*A. polycarpa*
Coyote bush	*Baccharis pilularis*
Mule fat	*B. viminea*
Tree tobacco	*Nicotiana glauca*
Current	*Ribes* spp.
Rose	*Rosa* spp.
Bush lupine	*Lupinus* spp.
Poison oak	*Rhus diversiloba*
Squaw bush	*R. trilobata*
Sage	*Salvia* spp.
Willow	*Salix* spp.
	Trees
Califoria box elder	*Acer negundo*
White alder	*Alnus rhombifolia*
Red alder	*A. rubra*
Western sycamore	*Plantanus racemosa*
Fremont cottonwood	*Populus fremontii*
Black cottonwood	*P. trichocarpa*
Coast live oak	*Quercus agrifolia*
Valley oak	*Q. lobata*
Scouler willow	*Salix scouleriana*
Willow	*Salix* spp.
Blue elderberry	*Sambucus caerulea*

Source: California Department of Fish and Game, Monterey, California, unpublished data.

Table H-2

SALINAS RIVER RIPARIAN VEGETATION SUBTYPE SURVEY

	(Vegetative Subtype (Acreage)									
Area Surveyed	Shrub-Herbaceous	Herbaceous	Shrub	Tree-Shrub	Tree-Herbaceous	Tree No Understory	Fresh Water Marsh	Salt Water Marsh	Total	Riparian Acreage Per Mile
Chualar Bridge to Salinas (Alisal) sewage treatment plant outfall (14 linear miles)	599	250	169	470	19	3	0	0	1,510	108
Salinas (Alisal) sewage treatment plant outfall to Pacific Ocean (10 linear miles)	338	141	38	360	0	0	2	63	942	88
Total Acreage/Subtype	937	391	207	830	19	3	2	63	2,452	102

Source: California Department of Fish and Game, Monterey, California, unpublished data.

Table H-3

FISH CAPTURED OR OBSERVED IN THE SALINAS RIVER LAGOON

Common Name	Scientific Name	Months of Capture or Observation
Striped bass	Morone saxatilis	July, September
Starry flounder	Platichthys stellatus	July
Carp	Cyprinus carpio	July, September
Sacramento hitch	Lavinia exilicauda	July
Sacramento blackfish	Orthodon microlepidotus	July, September
Green sturgeon	Acipenser medirostris	July
Sucker	Catostomus sp.	September
Sacramento squawfish	Ptychocheilus grandis	September
Top smelt	Atherinops affinis	December
Staghorn sculpin	Leptocottus armatus	December
Three-spine stickleback	Gasterosteus aculeatus	December
Shiner perch	Cymato gaster aggregata	December
Pacific herring	Clupea harengus pallasi	December
Pipefish	(Species Unknown)	December
Steelhead trout	Salmo gairdnerii gairdnerii	

Source: California Department of Fish and Game, unpublished data; Snider, pers. comm.

Table H-4

FAUNAL LIST

Mammals

Oppssum (Didelphis marsupialis)
Throwbridge Shrew (Sorex trowbridgei)
Ornate Shrew (Sorex ornatus)
California Mole (Scapanus latimanus)
Little Brown Myotis (Myotis lucifugus)
Fringed Myotis (Myotis thysanodes)
Long-eared Myotis (Myotis evotis)
Califonnia Myotis (Myotis californicus)
Yuma Myotis (Myotis yumanensis)
Long-legged Myotis (Myotis volans)
Silver-haired Bat (Lasionycteris notivagans)
Western Pipistrel (Pipistrellus hesperus)
Red Bat (Lasiurus borealis)
Big Brown Bat (Eptesicus fuscus)
Hoary Bat (Lasiurus cinereus)
Western Big-eared Bat (Plecotus townsendi)
Western Mastiff Bat (Emops perotis)
Pallid Bat (Antrozous pallidus)
Mexican Freetail Bat (Tadarida brasiliensis)
Racoon (Procyon lotor)
Ringtail (Bassariscus astutus)
Longtail Weasel (Mustela frenata)
Badger (Taxidea taxus)
Spotted Skunk (Spilogale putorius)
Striped Skunk (Mephitis mephitis)
Coyote(Canis latrans)
Grey Fox (Urocyon cinereoargenteus)
Mountain Lion (Felis concolor)
Bobcat (Lynx rufus)
California Ground Squirrel (Citellus beecheyi)
Merriam Chipmunk (Eutamias merriami)
Western Grey Squirrel (Sciurus griseus)
Valley Pocket Gopher (Thomomys bottae)
California Pocket Mouse (Perognatus californicus)
Heerman Kangaroo Rat (Dipodomys heermanni)
Santa Cruz Kangaroo Rat (Dipodomys venustus)
Beaver (Castor canadensis)
Western Harvest Mouse (Reithrodontomys megaletis)
California Mouse (Peromyscus californicus)
Deer Mouse (Peromyscus maniculatus)
Brush Mouse (Peromyscus boylei)
Pinon Mouse (Peromyscus truei)
Dusky-Footed Woodrat (Neotoma fuscipes)
California Vole (Microtus californicus)
Muskrat (Ondatra zibethica)
Norway Rat (Rattus norvegicus)
House Mouse (Mus musculus)
Blacktail Jackrabbit (Lepus californicus)

Desert Cottentail (Sylvilagus auduboni)
Brush Rabbit (Sylvilagus bachmani)
Wild Boar (Sus scrofa)
Mule Deer (Odocoileus hemionus)

Reptiles and Amphibians

Pacific Giant Salamander (Dicamptodon ensatus)
Tiger Salamander (Amtystoma tigrinum)
Rough-skinned Newt (Taricha granulose)
Ensatina (Ensatina aschscholtzi)
California Slender Salamander (Batrachoseps attenuatus)
Arboreal Salamander(Aneides lugubris)
Western Spadefoot (Scaphiopus hammondi)
Western Toad (Bufo boreas)
Pacific Treefrog (Hyla regilla)
Red-legged Frog (Rana aurora)
Bullfrog (Rana catesbeiana)
Foothill Yellow-legged Frog (Rana boylei)
Western Pond Turtle (Clymmys marmorata)
Western Fence Lizzard (Sceloporus occidentalis)
Sagebrush Lizzard (Sceloporus graciosus)
Side-blotched Lizzard (Uta stansburiana)
Coast Horned Lizzard (Phrynosoma coronatum)
Western Skink (Eumeces skiltonianus)
Western Whiptail (Cnemidophorus tigris)
Southern Aligator Lizzard (Gerrhonotus multicarinatus)
Northern Aligator Lizzard (Gerrhonotus coeruleus)
California Legless Lizzard (Anniella pulchra)
Rubber Boa (Charina bottae)
Ringneck Snake (Diadophus punctatus)
Sharp-tailed Snake (Contia tenis)
Striped Racer (Masticophis lateralis)
Coach whip (Masticophis flagellum)
Racer (Coluber constrictor)
Gopher Snake (Pituophis melanoleucus)
California Mountain Kingsnake (Lampropeltis zonta)
Common Kingsnake (Lampropeltis getulus)
Common Garter Snake (Thamnophis sirtalis)
Western Terrestial Garter Snake (Thamnopsis elegans)
Western Aquatic Garter Snake (Thamnopsis couchi)
Night snake (Hypsiglena torquata)
Western Rattlesnake (Crotalus viridis)

Birds

Pied-billed Grebe (Podilymbus podiceps)
Waterfowl (Potential Breeders only)
  Mallard (Anas platyrhynchos)
  Pintail (Anas acuta)

Gadwall (Anas strepera)
Sholver (Spatual clypeata)
Wood Duck (Aix sponsa)
Common Merganser (Mergus merganser)
Cinnamon Teal (Anas cyanoptera)
Ruddy Duck (Oxyura jamaicensis)
Turkey Vulture (Cathartes aura)
California Condor (Gymnogyps californianus)*
White-tailed Kite (Elanus leucurus)
Cooper's Hawk (Accipter cooperii)
Sharp-shinned Hawk (Accipter striatus)
Marsh Hawk (Circus syaneus)
Rough-legged Hawk (Buteo lagopus)
Ferruginous Hawk (Buteo regalis)
Red-tailed Hawk (Buteo jamaicensis)
Red-shouldered Hawk (Buteo lineatus)
Swainson's Hawk (Buteo swainsoni)
Golden Eagle (Aquila chrysaetos)
Bald Eagle (Haliaeetus leucocephalus)*
Osprey (Pandion haliaetus)
Prairie Falcon (Falco mexicanus)
Peregrine Falcon (Falco peregrinus)*
Pigeon Hawk (Falco columbarius)
Sparrow Hawk (Falco sparverius)
California Quail (Lophortyx californicus)
Mountain Quail (Oreortyx pictus)
Ring-necked Pheasant (Phasianus colchicus)
Turkey (Meleagris gallopavo)
Sandhill Crane (Grus canadensis)
Common Egret (Casmerodius albus)
Snowy Egret (Leucophoyx thula)
Great Blue Heron (Ardea herodias)
Green Heron (Butorides virescens)
Black-crown Night Heron (Nycticorax nycticorax)
American Bittern (Botaurus lentiginosus)
Least Bittern (Ixobrychus exilis)
Virginia Rail (Rallus limicola)
Sora (Porzana carolina)
Yellow Rail (Coturnicops noveboracensis)
Black Rail (Laterallus jamaicensis)
Common Gallinule (Gallinula chloropus)
American Coot (Fulica americana)
Killdeer (Charadrius vociferus)
Common Snipe(Capella gallinago)
Long-billed Curlew (Numenius americanus)
American Avocet (Recurvirostra americana)
Herring Gull (Larus argentatus)
California Gull (Larus californicus)
Ring-billed Gull (Larus delawarensis)
Mew Gull (Larus canus)
Caspain Tern (Hydroprogne caspia)

Band-tailed Pigeon (Columba fasciata)
Mourning Dove (Zenaidura macroura)
Yellow-billed Cuckoo (Coccyzus americanus)
Screech Owl (Otus asio)
Great Horned Owl (Bubo virginianus)
Short-eared Owl (Asio flammeus)
Barn Owl (Tyto alba)
Burrowing Owl (Speotyto cunicularia)
Pygmy Owl (Glaucidium gnoma)
Poor-will (Phalaenoptilus nuttallii)
Common Nighthawk (Chordeiles minor)
Vaux's Swift (Chaetura vauxi)
White-throated Swift (Aeronautes saxatalis)
Anna's Hummingbird (Calypte anna)
Black-chinned Hummingbird (Archilochus alexandri)
Rufous Hummingbird (Selasphorus rufus)
Allen's Hummingbird (Selasphorus sasin)
Belted Kingfisher (Megaceryle alcyon)
Red-shafted Flicker (Colaptes cafer)
Nuttall's Woodpecker (Dendrocopos nuttallii)
Acorn Woodpecker (Melanerpes formicivorus)
Lewis' Woodpecker (Asyndesmus lewis)
Yellow-bellied Sapsucker (Sphyrapicus varius)
Downy Woodpecker (Dendrocopos pubescens)
Western Kingbird (Tyrannus ~~vociferans~~ verticalis)
Ash-throated Flycatcher (Myiarchus cinerascens)
Black Phobe (Sayornis nigricans)
Western Flycatcher (Empidonax difficilis)
Western Wood Pewee (Contopus sordidulus)
Horned Lark (Eremophila alpestris)
Barn Swallow (Hirundo rustica)
Cliff Swallow (Petrochelidon pyrrhonota)
Violet-Green Swallow (Tachycineta thalassina)
Tree Swallow (Iridoprocne bicolor)
Bank Swallow (Riparia riparia)
Rough-wing Swallow (Stelgidopteryx ruficollis)
Purple Martin (Progne subis)
Steller's Jay (Cyanocilla stelleri)
Scrub Jay (Aphelocoma coerulescens)
Yellow-billed Magpie (Pica nuttalli)
Common Raven (Corvus corax)
Common Crow (Corvus caurinus)
Chestnut-backed Chickadee (Parus rufescens)
Plain Titmouse (Parus inornatus)
Common Bushtit (Psaltriparus minimus)
Wrentit (Chamaea fasciata)
Brown Creeper (Certhia familiars)
Dipper (Cinclus mexicanus)
White-breasted Nuthatch (Sitta carolinensis)
Red-breasted Nuthatch (Sitta canadensis)
House Wren(Troglodytes aedon)
Bewick's Wren (Thryomanes bewickii)
Rock Wren (Salpinctes obsoletus)

Canyon Wren (Catherpes mexicanus)
Long-billed Marsh Wren (Telmatodytes palustris)
Mockingbird (Mimus poluglottos)
California Thrasher (Toxostoma redivivum)
Robin (Turdus migratorius)
Varied Thrush (Ixoreus naevius)
Townsend's Solitaire (Myadestes townsendi)
Hermit Thrush (Hylocichla guttata)
Swainson's Thrush (Hylocichla ustulata)
Western Bluebird (Sialia mexicana)
Blue-Gray Gnatcatcher (Polioptila caerulea)
Ruby-crowned Kinglet (Regulus calendula)
Water Pipit (Anthus spinoletta)
Cedar Waxwing (Bombycilla cedrorum)
Phainopepla (Phainopepla nitens)
Loggerhead Shrike (Lanius ludovicianus)
Starling (Sturnus vulgaris)
Solitary Vireo (Vireo solitarius)
Bell's Vireo (Vireo bellii)
Hutton's Vireo (Vireo huttoni)
Warbling Vireo (Vireo gilvus)
Orange-crowned Warbler (Vermivora celata)
Nashville Warbler (Vermivora ruficapilla)
Yellow Warbler (Dendroica petechia)
Myrtle Warbler (Dendroica coronata)
Audubon's Warbler (Dendroica auduboni)
Townsend's Warbler (Dendroica townsendi)
Hermit Warbler (Dendroica occidentalis)
Black-throated Grey Warbler (Dendroica nigrescens)
Grace's Warbler (Dendroica graciae)
Yellowthroat (Geothlypis trichas)
Yellow-breasted Chat (Icteria virens)
MacGillivary's Warbler (Oporornis tolmiei)
Wilson's Warbler (Wilsonia pusilla)
House Sparrow (Passer domesticus)
Western Meadowlark (Sturnella neglecta)
Yellow-headed Blackbird (Xanthocephalus xanthocephalus)
Red-Winged Blackbird (Agelaius phoaniceus)
Tricolored Blackbird (Agelaius tricolor)
Brewer's Blackbird (Euphagus cyanocephalus)
Brown-headed Cowbird (Molothrus ater)
Baltimore (Bullock's) Oriole (Icterus galbula bullockii)
Western Tanager (Piranga ludoviciana)
Black-headed Grosebeak (Pheucticus melanocephalus)
Blue Grosebeak (~~Blue grosebeak~~ (Guiraca caerulea)
Lazuli Bunting (Passerina amoena)
Purple Finch (Carpodacus purpureus)
House Finch (Carpodacus mexicanus)
Pine Siskin (Spinus pinus)
American Goldfinch (Spinus tristis)
Lesser Goldfinch (Spinus psaltria)
Green-tailed Tohee (Chlorura chlorura)

Reproduced from best available copy.

Rufous-sided Towhee (Pipilo erythrophthalmus)
Savannah Sparrow (Passerculus sandwichensis)
Grasshopper Sparrow (Ammodramus savannarum)
Vesper Sparrow (~~[illegible]~~ (Pooecetes gramineus)
Lark Sparrow (Chondestes grammacus)
Sage Sparrow (Amphispiza belli)
Slate-colored Junco (Junco hyemalis)
Oregon Junco (Junco oreganus)
Chipping Sparrow (Spizella passerina)
White-crowned Sparrow (Zonotrichia leucophrys)
Golden-crowned Sparrow (Zonotrichia atricapilla)
White-throated Sparrow (Zonotrichia albicollis)
Fox Sparrow (Passerella iliaca)
Lincoln's Sparrow (Melospiza lincolnii)
Song Sparrow (Melospiza melodia)

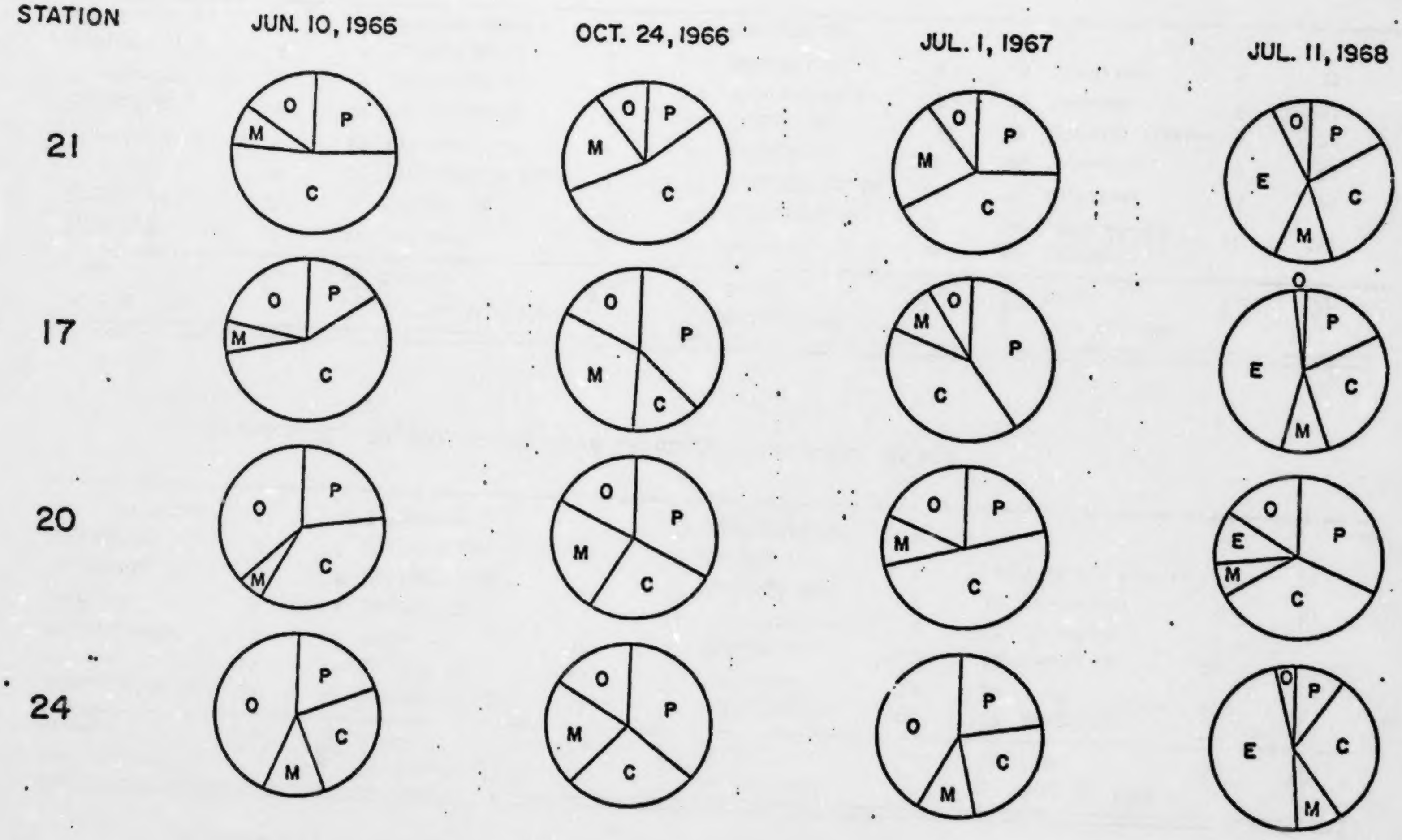
Source: California Department of Fish and Game, pers. comm.

* Species listed as rare and endangered under the California Endangered Species Act of 1970 and Sections 2050-2055 of the Fish and Game Code.

APPENDIX I

MARINE BIOTA

Figure I-1



BENTHIC STATION DATA, MONTEREY BAY

Station Composition by Major Taxonomic Groups:
P-Polychaeta, E-Echinodermata, C-Crustacea, M-Mollusca, O-Other Taxa

Sources: Chartock, PG&E Studies; Engineering Science, Inc., 1975a.

Table I-1. Characteristic shallow water benthos, southern Monterey Bay *

Station 17, 5,200' S. of Moss Landing, 8½ fathoms. (48')

June 10, 1066 Taxon	% com.	$\frac{\bar{x}}{kg}$	October 24, 1966 Taxon	% com.	$\frac{\bar{x}}{kg}$	July 1, 1967 Taxon	% com.	$\frac{\bar{x}}{kg}$	July 11, 1968 Taxon	% com.	$\frac{\bar{x}}{kg}$
Eohaustorius sp.	33	45	*Prionospio sp.*	19	28	*Prionospio sp.*	21	39	*Dendraster* excentricus	46	94
Nematoda	19	25	*Tellina sp.*	18	31	Ostracoda	20	36			
Phoxocephalid	13	18	Ostracoda	8	15	*Tellina sp.*	11	20	Ostracoda	18	40
Ostracoda	6	8	*Nephtys sp.*	7	12	Phoxocephalid	6	13	Spionidae	9	21
Prionospio sp.	6	8	*Dendraster sp.*	6	11	*Magelona sp.*	5	10	Gammaridae	8	20
Tellina sp.	4	5	*Magelona sp.*	6	9	*Nephtys sp.*	5	8	Hiatella arctica	6	14
Other Amphipoda	2	3	Pelycepoda	4	5	*Dendraster sp.*	2	4			

Station 21, 10,500' S. of Mosd Landing, 9 fathoms. (54')

June 10, 1966 Taxon	% com.	$\frac{\bar{x}}{kg}$	October 24, 1966 Taxon	% com.	$\frac{\bar{x}}{kg}$	July 1, 1967 Taxon	% com.	$\frac{\bar{x}}{kg}$	July 11, 1968 Taxon	% com.	$\frac{\bar{x}}{kg}$
Eohaustorius sp.	29	48	Ostracod	26	46	Ostracod	18	48	*Dendraster excentricus*	37	205
Dendraster sp.	10	16	*Tellina sp.*	20	32	*Prionospio sp.*	17	36			
Ostracod	9	15	*Eohaustroius sp.*	12	21	*Eohaustorius sp.*	14	35	Ostracoda	22	98
Phoxocephalid	9	16	Phoxocephalid	10	17	*Tellina sp.*	12	28	Spionidae	9	42
Tellina sp.	6	13	*Dendraster sp.*	8	13	*Spisula sp.*	9	19	Hiatella arctica	6	24
Other Polychaeta	6	9	*Prionospio sp.*	5	7	Phoxocephalid	6	15	Nematoda	6	22
Magelona sp.	6	9	*Nephtys sp.*	2	4	Nematoda	4	8	Gammaridae	6	25
Prionospio sp.	5	9	Other Amphipoda	2	3	*Magelona sp.*	3	7			

* Source: Chartock, 1969.

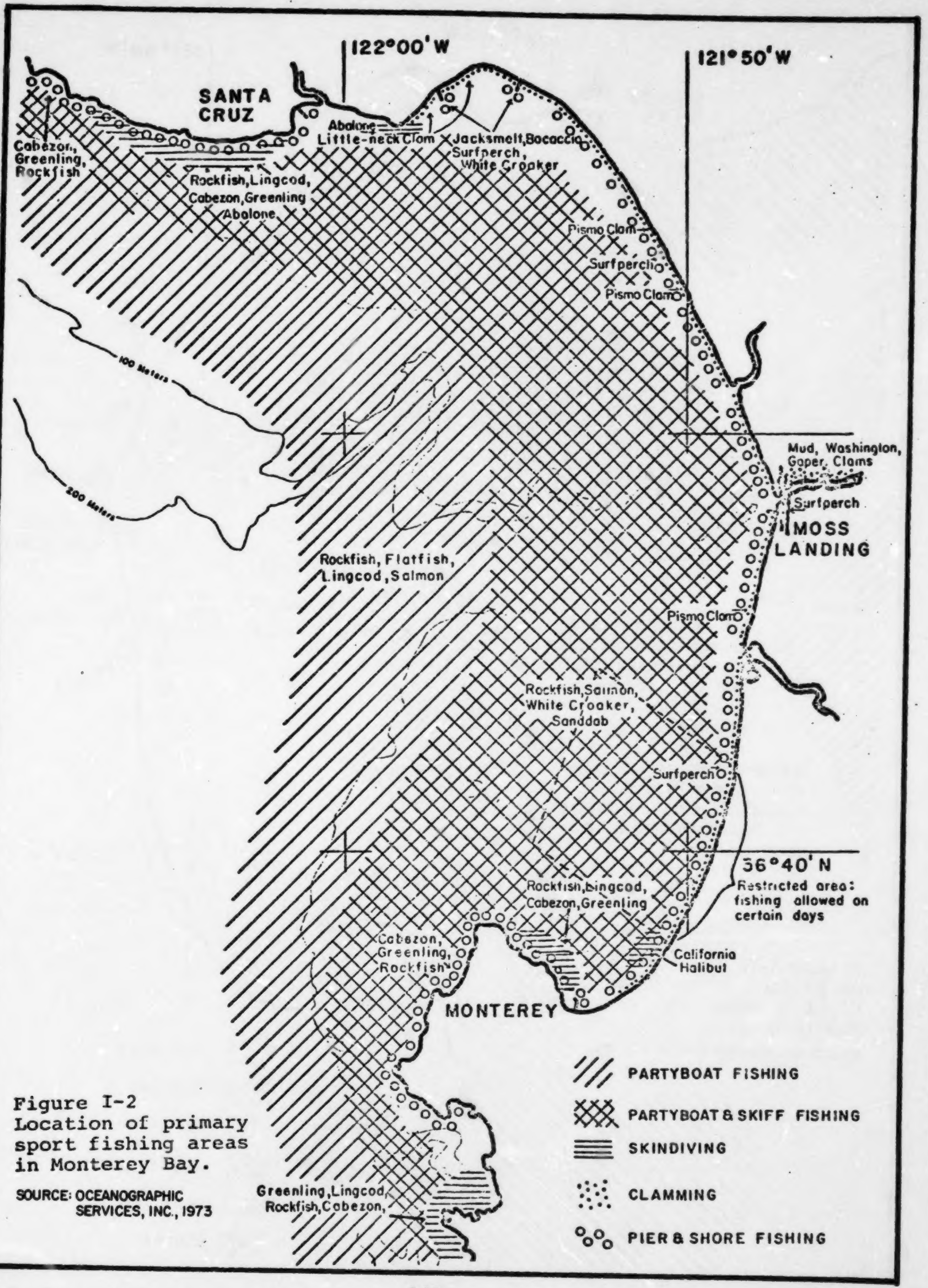
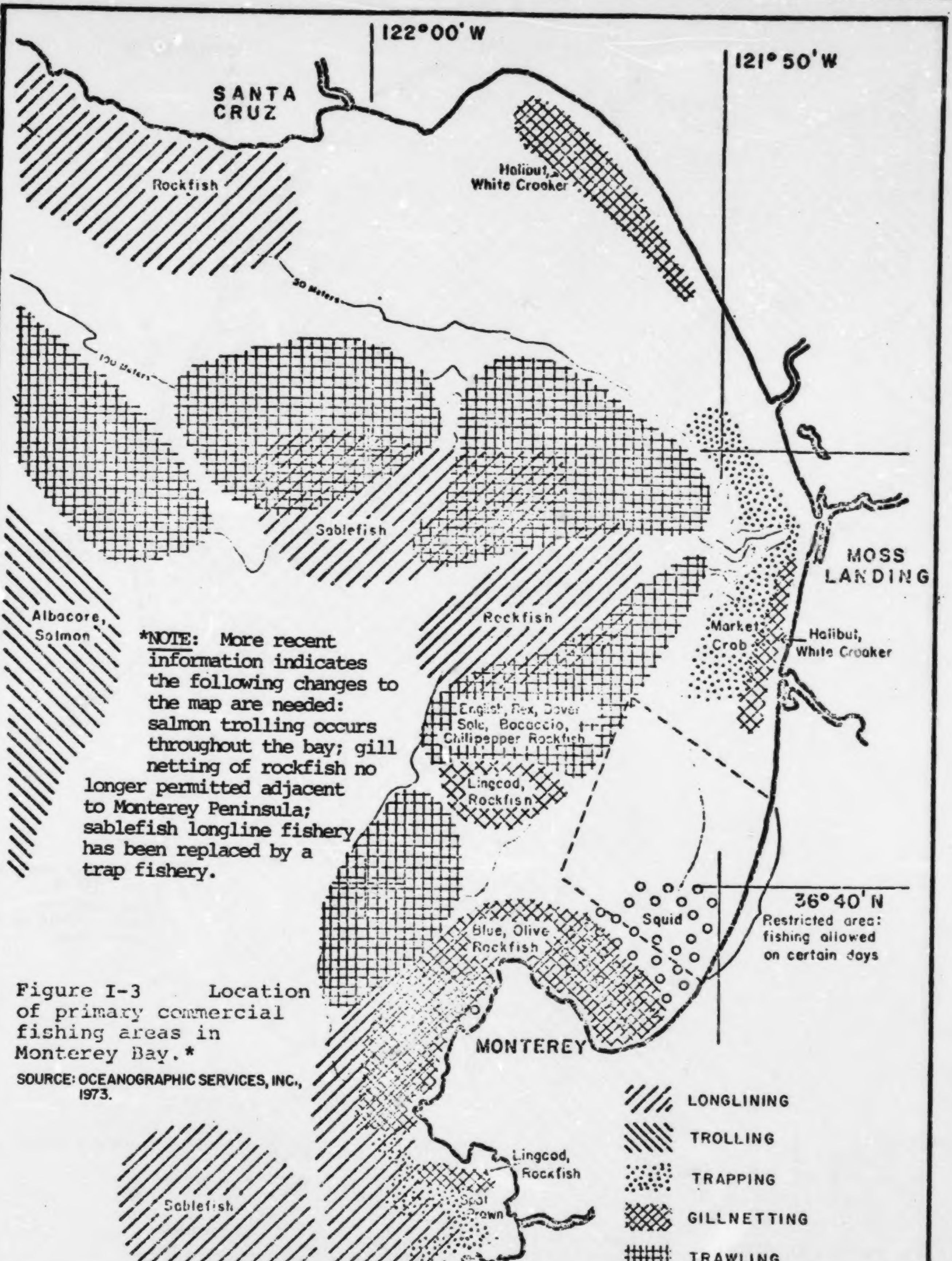

122°00'W
121° 50'W
SANTA CRUZ
Cabezon, Greenling, Rockfish
Abalone
Little-neck Clam
Jacksmelt, Bocaccio, Surfperch, White Croaker
Rockfish, Lingcod, Cabezon, Greenling, Abalone
Pismo Clam
Surfperch
Pismo Clam
100 Meters
200 Meters
Mud, Washington, Gaper, Clams
Surfperch
MOSS LANDING
Rockfish, Flatfish, Lingcod, Salmon
Pismo Clam
Rockfish, Salmon, White Croaker, Sanddab
Surfperch
36°40'N
Restricted area: fishing allowed on certain days
Rockfish, Lingcod, Cabezon, Greenling
Cabezon, Greenling, Rockfish
California Halibut
MONTEREY
Greenling, Lingcod, Rockfish, Cabezon,
PARTYBOAT FISHING
PARTYBOAT & SKIFF FISHING
SKINDIVING
CLAMMING
PIER & SHORE FISHING

Figure I-2
Location of primary sport fishing areas in Monterey Bay.

SOURCE: OCEANOGRAPHIC SERVICES, INC., 1973


122°00'W
121°50'W
SANTA CRUZ
Halibut, White Croaker
Rockfish
50 Meters
100 Meters
Sablefish
Rockfish
MOSS LANDING
Albacore, Salmon
Market Crab
Halibut, White Croaker
English, Rex, Dover Sole, Bocaccio, Chilipepper Rockfish
Lingcod, Rockfish
36°40'N
Squid
Restricted area: fishing allowed on certain days
Blue, Olive Rockfish
MONTEREY
Lingcod, Rockfish
Spot Prawn
Sablefish
LONGLINING
TROLLING
TRAPPING
GILLNETTING
TRAWLING
SEINING

*NOTE: More recent information indicates the following changes to the map are needed: salmon trolling occurs throughout the bay; gill netting of rockfish no longer permitted adjacent to Monterey Peninsula; sablefish longline fishery has been replaced by a trap fishery.

Figure I-3 Location of primary commercial fishing areas in Monterey Bay.*

SOURCE: OCEANOGRAPHIC SERVICES, INC., 1973.

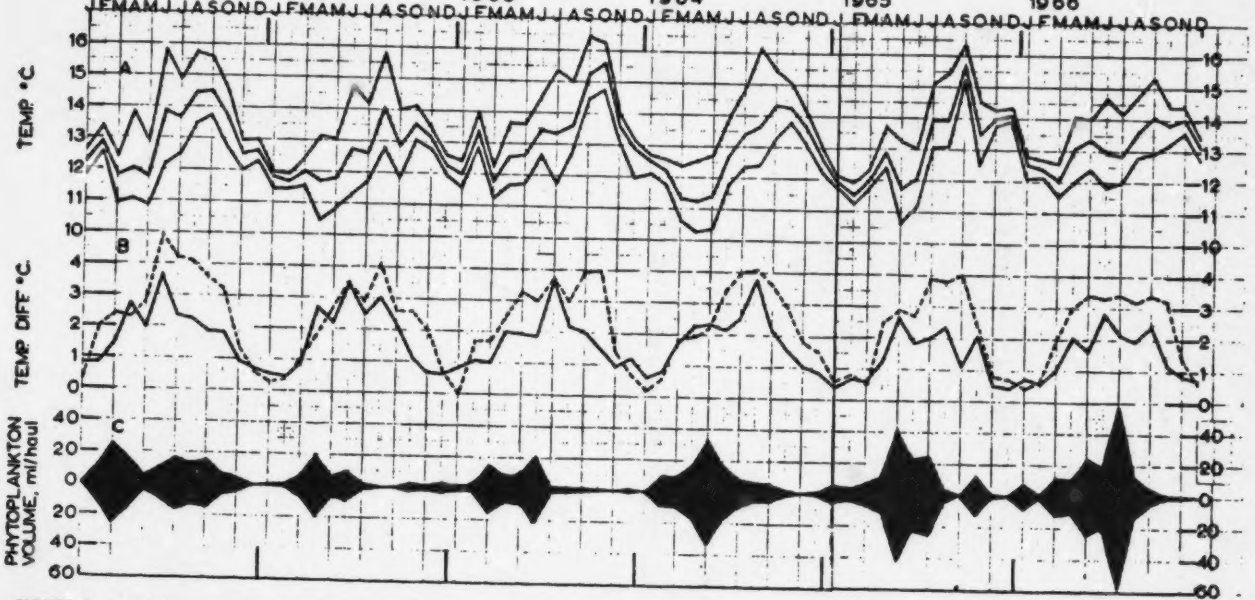


FIGURE 1. Monthly averages of temperature conditions and the volume of the phytoplankton standing crop in Monterey Bay, California, 1961 through 1966. A. Surface temperature (°C), showing monthly means, average monthly maxima, and average monthly minima. B. Solid line—temperature difference (°C) between average monthly maximum and average monthly minimum surface temperatures; broken line—temperature difference (°C) between monthly means of temperatures at the surface and those at 50 meters depth. C. Monthly averages of the volume of the phytoplankton standing crop (ml/haul).

FIGURE I-4 SUMMARY OF THERMAL CONDITIONS AND PHYTOPLANKTON VOLUMES MEASURED IN MONTEREY BAY, CALIFORNIA 1961-1966

SOURCE: ABBOTT & ALBEE, 1967

BACKGROUND DATA -- SOCIO-ECONOMIC ENVIRONMENT

APPENDIX J

POPULATION, EMPLOYMENT, MISCELLANEOUS SOCIO-ECONOMIC DATA

TABLE J-1

Age Characteristics of Population of Study Area Communities, 1960 and 1970

	% under 18		% 65 and Older		Median Age	
	1960	1970	1960	1970	1960	1970
Castroville	44.4	44.2	4.5	5.9	21.0	22.5
Marina	44.5	43.3	2.6	2.3	21.3	22.5
Monterey	33.8	28.7	6.1	8.3	27.0	26.2
Pacific Grove	30.6	24.4	14.5	17.4	33.6	34.4
Salinas	36.2	36.3	6.9	7.5	29.9	26.4
Seaside	43.2	35.1	3.7	2.9	23.2	21.3
County	34.3	32.9	6.2	7.5	24.8	24.2

Source: U.S. Census of Population, General Population Characteristics, California, 1960 (Tables 20, 23-25 and 27) and 1970 (Tables 24,28 and 31).

TABLE J-2

Median Income in Study Area Communities Compared to State, 1960 and 1970

	Median Income-Families			
	Income		As % of State Median Family Income	
	1960	1970	1960	1970
Castroville	4347	7345	64.6	68.4
Marina	4352	9231	64.7	86.0
Monterey	5884	10250	87.5	95.5
Pacific Grove	5848	9615	86.9	89.6
Salinas	7035	10285	104.6	95.8
Seaside	4572	7421	68.0	69.1
County	5770	9730	85.8	90.7
State	6726	10732	-	-

Source: U.S. Census of Population, General Social and Economic Characteristics, California, 1960 (Tables 36, 65, 76, 81 and 86) and 1970 (Tables 89 and 107)

TABLE J-3

Monterey/Salinas Area Employment by Industry (000's)

	50	52	56	58	60	62	64	66	68	70
Agriculture, forestry and fisheries	1.5*	1.5*	1.5	2.3	2.5	2.2	3.2	3.3	3.3	3.4
Mining	0.1	0.1	0.05	0.1	0.1	0.1	0.1	0.2	0.1	0.1
Contract Construction	2.8	4.2	2.5	2.4	3.0	3.2	4.1	3.7	3.9	3.2
Manufacturing	2.9	4.0	3.6	3.0	4.0	3.9	4.8	5.4	6.0	7.0
Durable goods	0.3	n.a.	0.4	0.6	1.1	0.9	0.9	1.0	1.3	1.5
Nondurable goods	2.6	n.a.	3.2	2.4	2.9	3.0	3.9	4.4	4.7	5.5
Food products	n.a.	n.a.	2.5	1.4	1.8	1.9	2.1	2.1	2.4	3.1
Other nondurable goods	n.a.	n.a.	0.7	1.0	1.1	1.1	1.8	2.3	2.3	2.4
Transportation, communication and utilities	1.6	1.9	2.25	2.2	2.5	3.0	3.2	3.2	3.4	3.3
Wholesale & retail trade	10.55	11.95	11.3	11.6	11.6	13.1	14.3	15.5	16.6	17.6
Finance, insurance and real estate	1.1	1.3	1.6	1.9	1.9	2.1	2.2	2.6	2.6	2.9
Service	6.05	9.4	9.7	10.0	8.7	10.1	11.4	12.1	13.1	15.5
Government	1.6	3.5	4.4	4.8	7.5	9.8	10.7	11.8	14.6	14.8
TOTAL	28.2	37.85	36.9	38.3	41.8	47.5	54.0	57.8	63.6	67.8

*Not reported by the state; assumed based on 1956 figure.

Source: State of California, Dept. of Human Resources Development (formerly Department of Employment), Research & Statistics. Community Labor Market Survey-Salinas & Monterey. Salinas Community Labor Market Area includes Salinas and Salinas South Census Divisions. Monterey Community Labor Market Area includes Monterey, Carmel, Monterey Peninsula, Pacific Grove and Seaside Census Divisions.

Table J-4

CHANGE IN TOTAL EMPLOYMENT FOR VARIOUS INDUSTRY SECTORS -- STUDY AREA COMPARED TO NATION, 1950-1970

	Change in Industry as % of Total Change			
	Includes Gov't. Employees		Excludes Gov't. Employees	
Industry Sector	Region	Nation	Region	Nation
Contract Construction	1.1	3.4	1.6	5.3
Manufacturing-				
Durable goods	3.2	12.1	4.9	16.2
Nondurable goods	7.7	4.1	11.8	5.4
TCU (transportation, communication & utilities)	4.5	1.8	6.9	2.4
Trade	18.7	21.6	28.8	29.1
FIRE (finance, insurance & real estate)	4.8	6.8	7.3	9.2
Service	25.1	24.1	38.6	32.4
Government	35.0	25.5	omitted	omitted

Source: U. S. Department of Commerce, County Business Patterns, 1970; and Community Labor Market Surveys, cited in Table 20.

TABLE J-5

Major Crops in Lower Salinas Valley Crop-Acres 1950-1974

Year	Artichokes	Broccoli	Cauliflower	Celery	Lettuce	Strawberries
1950	4,560	6,580	250	1,180	59,517	506
1951	4,945	6,000	300	1,480	55,330	541
1952	5,656	6,350	625	1,597	65,274	1,108
1953	6,015	4,500	680	1,891	60,442	793
1954	5,774	4,650	585	2,580	63,370	1,612
1955	5,800	8,000	1,155	2,740	64,420	2,416
1956	5,373	10,020	2[illegible]0	3,624	67,584	5,124
1957	5,662	7,600	1,880	4,350	62,962	6,800
1958	5,631	9,200	2,000	4,150	45,541	4,900
1959	5,802	9,100	2,690	4,621	48,370	4,450
1960	5,515	10,080	3,420	4,825	50,780	3,510
1961	5,480	10,300	3,735	5,040	47,200	3,660
1962	5,500	10,200	4,400	5,070	44,995	3,590
1963	6,260	13,000	5,030	5,600	50,620	3,674
1964	7,410	13,400	5,780	5,040	47,400	3,420
1965	7,440	11,820	5,850	5,070	44,000	2,969
1966	8,817	14,721	4,285	5,265	48,990	2,570
1967	8,575	18,180	6,984	5,260	50,340	2,200
1968	9,323	19,481	7,921	5,685	51,875	1,973
19[illegible]	9,900	14,730	8,600	6,209	51,820	2,194
1970	10,240	23,700	8,745	6,240	54,865	2,600
1971	10,530	24,200	9,420	5,775	55,000	2,457
1972	10,720	22,080	10,515	5,600	54,850	1,680
1973	10,480	25,440	9,775	5,910	52,260	1,885
1974	10,300	21,300	9,265	5,275	54,845	2,060

Source: Monterey County Annual Crop Report, 1950-1974.

TABLE J-6

Value of Major Crops in Lower Salinas Valley, 1950-1974 (Thousands of 1975 Dollars*)

YEAR	ARTICHOKES	BROCCOLI	CAULIFLOWER	CELERY	LETTUCE	STRAW-BERRIES	TOTAL
1950	3,901	5,721	181	6,767	55,145	10,492	82,207
1951	3,704	7,370	370	5,771	89,355	8,981	115,551
1952	4,449	7,605	870	7,000	76,033	12,210	108,167
1953	3,402	4,467	683	6,980	89,624	8,293	113,449
1954	3,994	4,621	724	11,184	82,990	15,355	118,868
1955	4,046	7,195	1,479	14,736	83,807	18,479	129,742
1956	4,312	5,727	6,481	9,216	71,487	22,961	120,184
1957	4,619	5,529	2,239	13,347	75,023	19,324	120,079
1958	4,998	6,844	2,252	11,727	45,473	16,637	87,931
1959	6,050	6,663	4,214	21,300	58,896	20,523	117,646
1960	6,614	8,281	5,024	16,352	48,685	31,534	116,490
1961	5,994	8,391	6,366	19,994	54,871	23,099	118,715
1962	6,199	7,626	9,264	16,223	67,836	25,127	132,275
1963	7,733	10,538	6,723	18,886	66,443	30,073	140,396
1964	7,804	9,101	7,841	22,235	89,722	27,994	164,697
1965	8,793	11,188	8,166	24,481	87,918	23,748	164,294
1966	9,382	9,704	21,425	29,894	93,563	21,862	185,830
1967	10,551	14,981	9,470	22,401	107,466	16,237	181,106
1968	9,824	16,478	11,290	21,736	90,983	24,054	174,365
1969	9,403	17,514	13,942	30,237	81,327	19,156	171,579
1970	11,098	21,558	13,118	18,581	99,232	22,643	186,230
1971	12,822	20,526	16,783	30,535	102,014	23,726	206,406
1972	13,153	23,549	17,291	28,476	95,285	21,206	198,960
1973	13,833	25,275	14,655	21,231	154,642	24,894	254,530
1974	14,621	20,523	16,393	22,224	126,815	24,256	224,832

*Conversion to 1975 dollars by Gruen Gruen + Associates based on wholesale price index (WPI). Data on WPI for 1950-1973 from Bureau of Labor Statistics, 1974, Handbook of Labor Statistics and for 1974-75 from Wall Street Journal, Sept. 22, 1975.

Source: Monterey County Annual Crop Report,
1950-1974.

Table J-7

PRIVATE WASTE TREATMENT FACILITIES

Facility	Location	Design Capacity	Major Process Units
Oak Hills Subdivision	Hwy. 156, near Castroville	150,000	Comminutor Percolation Ponds
Monte Del Laguna Mobile Home Park	Castroville Blvd., near Castroville	116,000	Comminutor Aerated Ponds
Salinas	Services Toro Park Estates, Creekside, Toro Creek and Serra Village along Monterey Salinas Hwy.	270,000	Aerated Ponds Chlorination
Indian Springs Ranch Subdivision	River Road, Salinas	90,000	Package Aeration Plant Percolation Ponds Chlorination
Firestone Tire and Rubber Co.	340 El Camino Real South Salinas	50,000 (sanitary) 150,000 (industrial)	Package Aeration Plant Percolation Ponds

Source: Engineering Science, Inc., 1975.

Table J-8

COMMUNITY AND COMMON SEPTIC TANKS WITHIN THE STUDY AREA

1. Kubisch Mobile Home Park - 800 Dolan Road, Castroville. Design capacity - 50 mobile homes (1 system), 12,500 gallon tank + 6,250 square feet drainfield.
2. Moss Landing Mobile Manor - Struve Road, Moss Landing. Design capacity - 105 mobile homes (2 systems).
3. Cabana Holiday - Highway 101 North, Salinas. Design capacity - 103 units on 6 systems.
   a. Two 7,000 gallon tanks + 20 sumps (40'-60') with distribution box (5 per) servicing 48 mobile homes and 16 travel trailers.
   b. 9,000 gallon tank + 20 sumps (40'-60') with distribution box (5 per) servicing 12 motel units and 9 travel trailers.
   c. 8,000 gallon tank + 5 sumps and 2 drainfields with distribution box (equal flow) servicing 8 motel units and 9 travel trailers.
   d. 2,500 gallon tank + hooked into sumps for (b) for 16 travel trailers.
   e. 2,000 gallon tank and unknown drainage for office and clubhouse.
4. Laguna Seca Estates - Monterey-Salinas Highway. Design capacity - 45 units (26 developed) on 1 system (3-7,500 increments) 22,500 gallon septic tank + 45 sumps + repairs. This is a county service area.
5. Monterey Dunes Colony - Molera Road, Moss Landing. Design capacity - 120 units on 8 systems. 12 to 16 units per 6,000 gallon tank + 1,800-2,500 square feet of drainage.

Source: Engineering Science, Inc., 1975.

Table J-9

ZONING SUMMARY CHART

CLASIFICATION	ZONE	USES ALLOWEU (PARTIAL LIST)	MAX. HGHT.	MIN. REQ'D. YDS. UNLESS COMBINED WITH 'B' DISTRICT						EAGLE PRISMACOLOR PENCIL CHART
				FRONT	SIDE	REAR	MIN. AREA	MIN. WIDTH	LOT COV.	
AGRICULTURE	F	AGRICULTURAL AGRICULTURAL USES ONE FAMILY DWELLING WITH USE PERMIT LABOR CAMP ANIMAL HOSPITAL CATTLE FEED LOT ANIMAL SALES YARD	35'	30'	10% AVE. LOT WIDTH	20'	2 1/2 ac.	100'	35 %	909 GRASS GREEN
	K	AGRICULTURAL - RESIDENTIAL SAME AS 'F' DISTRICT	35'	20'	6'	20'	10,000□'	60'	35 %	910 EMERALD GREEN
	AP	AGRICULTURAL - PRESERVE SAME AS 'F' DISTRICT	35'	30'	20'	20'	40 ac.	NONE	NONE	942 YELLOW OCHRE
	N	RURAL SAME AS 'F' DISTRICT	35'	60'℄	10'	10'	20,000□'	100'	NONE	912 APPLE GREEN
	T	TRANSITIONAL SAME AS 'F' DISTRICT	35'	20'	6'	20'	10.000□'	60'	35%	904 LIGHT BLUE
RESIDENTIAL	R-1	ONE FAMILY RES. ONE FAMILY DWELLING WITH USE PERMIT COUNTRY CLUB PUBLIC & QUASI PUBLIC USES	30'	20'	6'	10'	6.000□'	60'	35%	915 LEMON YELLOW
	R-2	DUPLEX RES. ONE FAMILY DWELLING DUPLEX WITH USE PERMIT USES ALLOWED IN 'R-1' DISTRICT HOSPITAL RESTHOME	30'	20'	6'	10'	6,000□'	60'	40%	917 YELLOW ORANGE
	R-3	LIMITED MULTI. FAMILY RES. ONE FAMILY DWELLING DUPLEX WITH USE PERMIT USES ALLOWED IN 'R-2' DISTRICT RESORT HOTEL PROFESSIONAL OFFICE	45'	20'	5'	10'	6000□'	60'	60%	937 FLESH
	R-4	MULTI. FAMILY RES. ONE FAMILY DWELLING DUPLEX MULTIPLE DWELLING DWELLING GROUP WITH USE PERMIT USES ALLOWED IN 'R-3' DISTRICT HOTEL MOBILE HOME PARK	35'	20'	5'	10'	6000□'	60'	60%	918 ORANGE
	*	THIS LIST IS A SUMMARY OF ZONING DISTRICTS AS DESCRIBED IN THE ZONING ORDINANCE AND IS NOT PART OF THE ZONING ORDINANCE. FOR COMPLETE INFORMATION REFER TO THE ZONING ORDINANCE.								

Source: Monterey County Planning Department, pers. comm.

ZONING SUMMARY CHART

CLASSIFICATION	ZONE	USES ALLOWED (PARTIAL LIST)	MAX. HGHT.	MIN. REQ'D. YDS. FRONT	SIDE	REAR	MIN. AREA	MIN WIDTH	LOT COV.	EAGLE PRISMACOLOR PENCIL CHART
				UNLESS COMBINED WITH "B" DISTRICT						
RESIDENTIAL	ST	SPECIAL TREATMENT ONE FAMILY DWELLING WITH USE PERMIT MULTIPLE RESIDENCES TO DESIGNATED DENSITY	AS APP.	AS APP.	10'	10'	5 AC.	AS APP	AS DETERM. BY DESIGN	941 RAW UMBER
	SC	SCENIC CONSERVATION ONE FAMILY DWELLING AGRICULTURAL USES WITH USE PERMIT COUNTRY CLUB DUPLEX MULTIPLE DWELLING DWELLING GROUP HOTEL AUTOMOBILE COURT	20'	100'	10'	20'	AS SHOWN ON SECTION	100'	NONE	907 PEACOCK GREEN
COMMERCIAL	C-1	RETAIL BUSINESS RETAIL BUSINESS WITH USE PERMIT DWELLING USES SERVICE STATION DRIVE-IN RESTAURANT ADVERTISING SIGNS	35'	NONE	NONE	5' W/ ALLEY — 15' W/O ALLEY	2000*	25'	NONE	924 CRIMSON
	H-1	HIGHWAY FRONTAGE ONE FAMILY DWELLING WITH USE PERMIT DUPLEX MULTIPLE DWELLING AUTOMOBILE COURT SERVICE STATION RESTAURANT	35'	30'	6'	20'	6000*	60'	40%	944 TERRA COTTA
	PC	PLANNED COMMERCIAL W/ GEN. DEVELOPMENT PLAN & ZONING PERMIT RETAIL STORES SERVICE STATION HOTEL PUBLIC & QUASI PUBLIC USES	AS APP.	AS APP.	AS APP.	AS APP.	AS APP.	AS APP.	25%	905 AQUA-MARINE
	C-2	GENERAL COMMERCIAL RETAIL BUSINESS SERVICE STATION WITH USE PERMIT DWELLING USES CONTRACTORS YARD WELDING SHOP ADVERTISING SIGNS	45'	NONE	NONE	5' W/ ALLEY — 15' W/O ALLEY	2000*	25'	NONE	967 LIGHT GREY

* THIS LIST IS A SUMMARY OF ZONING DISTRICTS AS DESCRIBED IN THE ZONING ORDINANCE AND IS NOT PART OF THE ZONING ORDINANCE. FOR COMPLETE INFORMATION REFER TO THE ZONING ORDINANCE.

ZONING SUMMARY CHART

CLASSIFICATION	ZONE	USES ALLOWED (PARTIAL LIST)	MAX. HGHT.	MIN. REQ'D. YDS. UNLESS COMBINED WITH 'B' DISTRICT			MIN. AREA	MIN. WIDTH	LOT COV.	EAGLE PRISMACOLOR PENCIL CHART
				FRONT	SIDE	REAR				
COMMERCIAL	CR	COMMERCIAL RECREATION BOAT RENTALS SALE OF MARINE SUPPLYS DOCK, PIER, MARINA WITH USE PERMIT MARINE SERVICE ESTABLISHMENT RESTAURANT MOTEL TRAILER CAMP	35'	NONE	NONE	NONE	6,000*	60'	NONE	929 PINK
INDUSTRIAL	LM	LIMITED INDUSTRIAL MANUFACTURE OF CLOTHING PRINTING SHOP PROFESSIONAL OFFICE RESEARCH LABRATORY WITH USE PERMIT RESIDENTIAL USES FURNITURE MANU.	35'	50'	10% LOT WIDTH	50'	1 ACRE	NONE	25%	932 VIOLET
	M	INDUSTRIAL RETAIL BUSINESS SERVICE STATION WITH USE PERMIT RESIDENTIAL USES WRECKING YARD MANU. OF ACID SMELTING OF ORES ADVERTISING SIGNS	75'	10% LOT DEPTH	10% LOT WIDTH	10% LOT DEPTH	10,000*	100'	50%	901 INDIGO
COMBINING	A	LIMITED AGRICULTURE ANIMAL HUSBANDRY SMALL LIVESTOCK FARMING WITH USE PERMIT DOG & CAT KENNEL RIDING ACADEMY		ACCESSORY BUILDINGS 50'	20'	20'				
	S	INTEGRATED ALL USES PERMITTED IN RESPECTIVE DISTRICTS WITH WHICH IT'S COMBINED WITH USE PERMIT DUPLEX MULTIPLE DWELLING DWELLING GROUPS								
	P	PARKING ESTABLISHES PARKING REGULATIONS FOR MOST USES								
	*	THIS LIST IS A SUMMARY OF ZONING DISTRICTS AS DESCRIBED IN THE ZONING ORDINANCE AND IS NOT A PART OF THE ZONING ORDINANCE. FOR COMPLETE INFORMATION REFER TO THE ZONING ORDINANCE.								

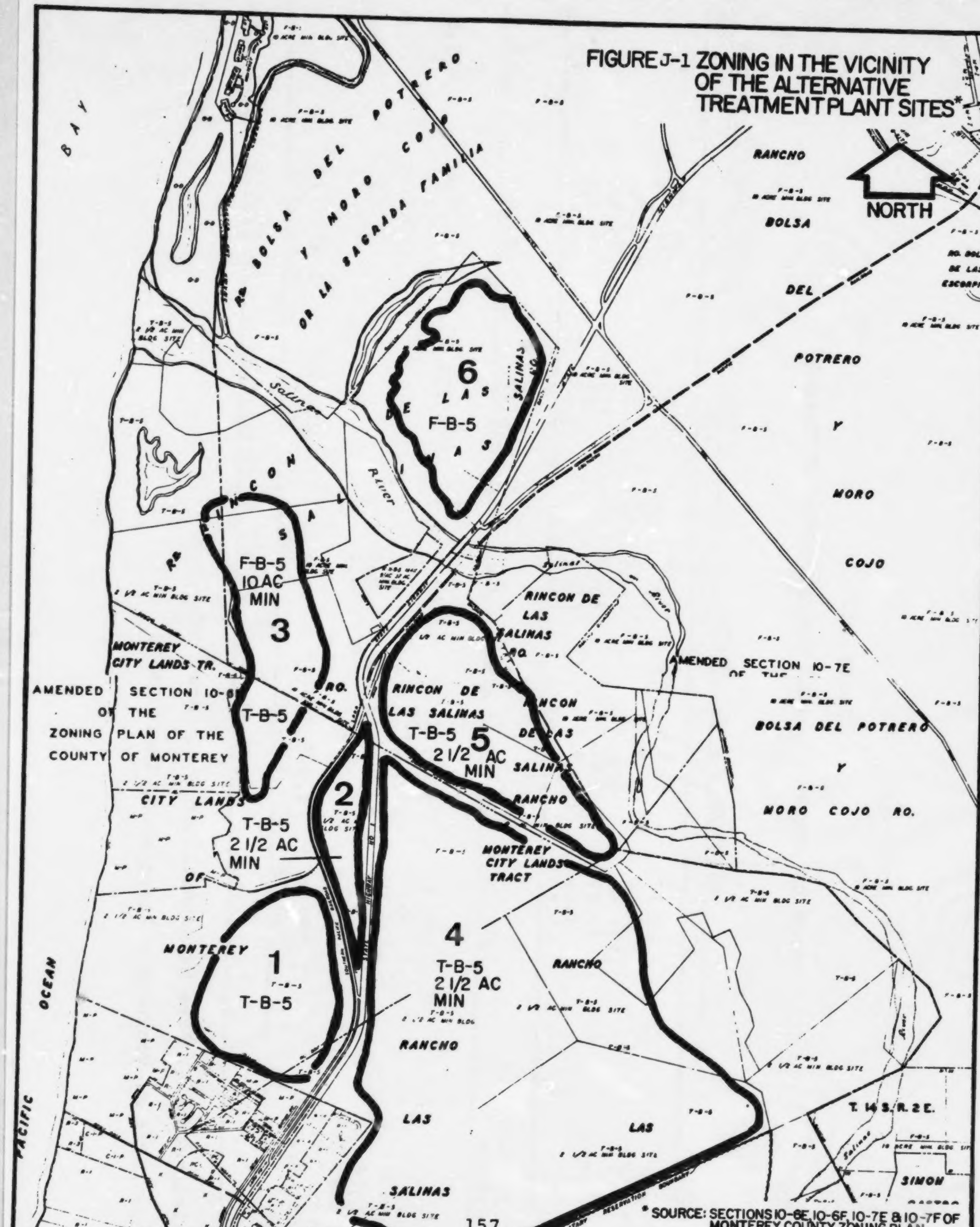
ZONING SUMMARY CHART

CLASIFICATION	ZONE	USES ALLOWED (PARTIAL LIST)	MAX. HGHT.	MIN. REQ'D. YDS.			MIN. AREA	MIN. WIDTH	LOT COV.	EAGLE PRISMACOLOR PENCIL CHART
				FRONT	SIDE	REAR				
				UNLESS COMBINED WITH A 'B' DISTRICT						
COMBINING	B	**BUILDING SITE** WHEN COMBINED WITH ANY DISTRICT SETS UP THE BUILDING REQUIREMENTS								
		B-1		25'	10% AVERAGE LOT WIDTH	10'	8000□			
		B-2		25'		10'	10000□			
		B-3		30'		15'	20000□			
		B-4		30'		20'	1 ACRE			
		B-5		AS SHOWN ON SECTIONAL DISTRICT MAPS BUT NOT LESS THAN B-4						
		B-6		AS SHOWN ON FINAL SUBDIVISION MAPS BUT NOT LESS THAN B-4						
	G	**RURAL PROFESSIONAL** ALL USES PERMITTED IN RESPECTIVE DISTRICT WITH WHICH THIS DISTRICT IS COMBINED WITH USE PERMIT								
		RESORT HOTEL					10 ACRE			
		HOSPITAL					10 ACRE			
		EXECUTIVE OFFICES					5 ACRE			
		RESEARCH LABORATORY					10 ACRE			
	X	**CAMP** WITH USE PERMIT CAMP GROUND TENT CAMP TRAILER CAMP TROUT FARM MOBILE HOME PARK								
	E	**FRONTAGE EXEMPTION** LOTS 2 1/2 ACRES OR GREATER ARE EXEMPT FROM FRONTAGE REQUIREMENT								
	FP	**FLOOD PLAIN** WITH USE PERMIT USES ALLOWED IN DISTRICT WITH WHICH DISTRICT IS COMBINED PRIVATE & PUBLIC RECREATIONAL USES								
	P	**PARKING** ESTABLISHES PARKING FOR MOST USES								
	D	**DESIGN CONTROL** REQUIRES APPROVAL OF DESIGN AND COLOR OF BUILDINGS AND STRUCTURES								
	O	**OPEN SPACE** DESIGNED TO HOLD FOR FUTURE GENERATIONS OPEN SPACE IN WHICH TREES AND PLANTS MAY GROW								911 OLIVE GREEN
	*	THIS LIST IS A SUMMARY OF ZONING DISTRICTS AS DESCRIBED IN THE ZONING ORDINANCE AND IS NOT PART OF THE ZONING ORDINANCE. FOR COMPLETE INFORMATION REFER TO THE ZONING ORDINANCE.								

ZONING SUMMARY CHART

CLASSIFICATION	ZONE	USES ALLOWED (PARTIAL LIST)	MAX. HGHT.	MIN. REQ'D YDS. FRONT	SIDE	REAR	MIN AREA	MIN WIDTH	LOT COV.	EAGLE PRISMACOLOR PENCIL CHART
				UNLESS COMBINED WITH 'B' DISTRICT						
COMBINING	Y	AIRPORT AIRPORTS WITH USE PERMIT ACCESSORY USES TO AIRPORT								931 PURPLE
	L	MOBILE HOME WITH USE PERMIT MOBILE HOMES								
	J	TRAILER EXCLUSION NO MOBILE HOMES AS LIVING UNITS								
	Z	IMPROVEMENT DEDICATE O.P.L. AREA INSTALL SIDEWALK, CURB, GUTTER, EXTEND PAVEMENT								
	U	UNCLASSIFIED ALL USES EXCEPT THOSE REQUIRING A USE PERMIT WITH USE PERMIT LABOR CAMPS JUNK YARD ASSEMBLY OF PEOPLE MOBILE HOME PARK					2 1/2 ac			
	*	THIS LIST IS A SUMMARY OF ZONING DISTRICTS AS DESCRIBED IN THE ZONING ORDINANCE AND IS NOT PART OF THE ZONING ORDINANCE. FOR COMPLETE INFORMATION REFER TO THE ZONING ORDINANCE.								

FIGURE J-1 ZONING IN THE VICINITY OF THE ALTERNATIVE TREATMENT PLANT SITES*


NORTH
BAY
PACIFIC OCEAN
RO. BOLSA DEL POTRERO Y MORO COJO OR LA SAGRADA FAMILIA
RANCHO BOLSA DEL POTRERO Y MORO COJO
RO. BOLSA DE LAS ESCORPINAS
RO. RINCON DE LAS SALINAS
Salinas River
RINCON DE LAS SALINAS RO.
RANCHO RINCON DE LAS SALINAS
BOLSA DEL POTRERO Y MORO COJO RO.
MONTEREY CITY LANDS TR.
MONTEREY CITY LANDS TRACT
CITY LANDS OF MONTEREY
AMENDED SECTION 10-6E OF THE ZONING PLAN OF THE COUNTY OF MONTEREY
AMENDED SECTION 10-7E OF THE
RANCHO LAS SALINAS
RANCHO LAS SALINAS
T. 14 S. R. 2 E.
SIMON CASTRO
RANCHO
MILITARY RESERVATION BOUNDARY
STATE HIGHWAY NO 1
6
F-B-5
3
F-B-5
10 AC MIN
T-B-5
5
T-B-5
2 1/2 AC MIN
2
T-B-5
2 1/2 AC MIN
1
T-B-5
4
T-B-5
2 1/2 AC MIN
F-B-5
10 ACRE MIN BLDG SITE
T-B-5
2 1/2 AC MIN BLDG SITE
M-P
B-1
C-1-P

* SOURCE: SECTIONS 10-6E, 10-6F, 10-7E & 10-7F OF MONTEREY COUNTY ZONING PLAN; ZONING DESIGNATIONS INCLUDED IN APPENDIX

Table J-10

MILES OF ROADS AND DAILY VEHICLE MILES OF TRAVEL

Jurisdiction	MILES OF ROADS/STREETS 1972	MILES OF ROADS/STREETS 1973	MILES OF ROADS/STREETS % Change	VEHICLE MILES OF TRAVEL PER DAY 1972	VEHICLE MILES OF TRAVEL PER DAY 1973	VEHICLE MILES OF TRAVEL PER DAY % Change
Carmel	27.70	27.70	0.0	33,000	34,000	+3.0
Del Rey Oaks	5.62	5.90	+5.0	1,700	1,700	0.0
Monterey	108.67	108.67	0.0	434,500	456,464	+5.1
Pacific Grove	48.08	54.80	+14.0	54,700	76,092	+39.1
Sand City	4.09	4.09	0.0	614	614	0.0
Seaside	65.50	65.63	+0.2	114,100	117,028	+2.5
Subtotal, Study Area Cities	259.66	266.79	+2.7	638,614	685,898	+7.4
Salinas	160.32	160.94	+0.4	518,234	572,754	+15.3
Gonzales	9.00	9.00	0.0		7,200	
Soledad	11.05	11.05	0.0		10,000	
Greenfield	9.73	9.73	0.0		6,100	
King City	15.13	15.13	0.0		22,750	
Monterey County Unincorporated	1,335.80	1,329.56	-0.5	621,400*	1,292,112	
CALTRANS	300.79	300.77	0.0	1,635,500*	2,868,835	
TOTAL	2,101.48	2,102.97	+0.1	3,392,514*	5,465,649	

* Salinas-Monterey Area Transportation Study area only.

Source: Alan M. Voorhees & Associates, Inc., 1975.

Table J-11*

TYPICAL CONSTRUCTION EQUIPMENT FUEL CONSUMPTION RATES

Diesel	Diesel gal/hr	Gasoline gal/hr
Tracklaying tractor	4.38	
Wheeled tractor	2.91	2.97
Wheeled dozer	11.30	
Scraper	14.83	
Motor grader	3.10	3.11
Wheeled loader	5.97	4.28
Tracklaying loader	2.42	
Off-highway track	14.57	
Roller	2.22	3.47
Miscellaneous	4.52	4.31

* Calculated from exhaust hydrocarbon emission factors given in U. S. Environmental Protection Agency, 1976.

PROJECT ENGINEERING PROPOSALS

APPENDIX K

PROPOSED TREATMENT PROCESSES AND LEVELS

DESCRIPTION OF PROPOSED TREATMENT PROCESSES AND EFFLUENT QUALITY

In the interest of clarity and brevity, the text discussion of the five selected alternatives did not provide a description of the processes to be utilized nor the anticipated effluent quality. This appendix is included to provide this information. Should the reader desire additional information, he is referred to the companion document to this EIS, Facilities Plan for North Monterey County, prepared by Engineering Science, Inc. (ESI) for the Monterey Peninsula Water Pollution Control Agency.

In the text of the EIS, mention is made of various levels of treatment. These levels, developed by ESI and not identical to RWQCB levels, are defined as follows:

Level I-A: Biological treatment plus limited disinfection.

Level I-B: Biological treatment plus extensive disinfection.

Level II: Level I-B plus filtration.

Level III: Level I-B plus filtration and nitrification.

Level IV: Level I-B plus chemical coagulation, settling and filtration.

Level V: Level I-B plus nitrification, denitrification, chemical coagulation, settling and filtration.

Table K-1 shows the effluent quality each process would be expected to produce while Table K-2 lists the quality of existing wastewater discharges.

In the following section, the treatment levels are described and then the project alternatives are described in terms of the process flow which has been recommended by ESI.

Table K-1

TREATMENT PROCESSES AND EFFLUENT QUALITY

			Effluent quality							
					Bacteriological		Toxicants		Biostimulants	
Treatment level	Process description	Disposal mode	Suspended solids, mg/l	BOD_5, mg/l	Total coliform, MPN/100 ml	Fecal coliform, no./100 ml	Ammonia[a], mg/l	Toxicity, t.u.	Total nitrogen, mg/l	Total phosphorus, mg/l
IA	Sedimentation, carbonaceous oxidation, disinfection	Ocean disposal	30	30	1,000	200	25	0.8	45	8
IB	Sedimentation, carbonaceous oxidation, disinfection	Salinas River during winter **infiltration/ percolation**	30	30	23		25	0.8	45	8
II	Sedimentation, carbonaceous oxidation, filtration, disinfection	Infiltration/ percolation	5	15	2.2		25	0.8	30	6
III	Sedimentation, carbonaceous oxidation, nitrification, filtration, disinfection	**Salinas River during summer - Stage 1**	5	10	2.2		0.5	0.6	30	6
IV	Sedimentation, carbonaceous oxidation, chemical coagulation, sedimentation, filtration, disinfection	Reuse: Spray irrigation of food crops	2	5	2.2		20	0.6	30	1.5
V	Sedimentation, carbonaceous oxidation, nitrification, nutrient removal, chemical coagulation, sedimentation, filtration, disinfection	Salinas River discharge during summer **Stage 2**	2	5	2.2		0.5	0.1	5	0.5

[a] Ammonia expressed as nitrogen

Source: Engineering Science, Inc., 1976b.

Table K-2

TYPICAL CONCENTRATIONS OF CHEMICAL CONSTITUENTS IN WASTEWATER EFFLUENTS, MG/L

Constituent	Salinas No. 1	Monterey	Fort Ord	Pacific Grove	Seaside	Marina	Salinas No. 2	Castroville	Flow, weighted avg
Major anions									
Bicarbonate	179	78	131	170	320	--	147	302	164
Chloride	290	182	162	136	365	285	143	175	231
Sulfate	142	98	100	70	110	75	78	49	109
Nitrate as NO_3	26.6	2.2	0.4	6	1.6	--	44.3	0.75	12.9
Phosphate as PO_4	--	34	25.6	33	28.2	--	--	40	30.8
Major cations									
Sodium	178	150	88	74.6	215	178	72	141	146
Potassium	10.4	13.2	8.4	20	22.5	13	7.0	16.8	12.8
Calcium	15.0	44.6	96	34.5	65.5	53	49	102	45.0
Magnesium	28.0	21.0	23.9	14.0	22.0	22	32	13.8	23.6
Other data									
Total nitrogen	37.1	39	17.2	--	44.0	--	28.9	--	34.3
Boron	0.7	--	0.41	0.6	0.5	0.4	0.1	1.2	0.57
Hardness	296	200	--	150	299	--	22.4	204	248
TDS/EC[a]	953/1,490	666/1,040	696/1,088	493/771	1,024/1,600	813/1,270	444/694	711/1,111	783/1,223
Cadmium	<0.001	0.004	0.003	<0.001	<0.001	<0.001	--	--	<0.001
Chromium	<0.05	<0.01	0.015	0.02	<0.02	<0.02	--	0.02	<0.03
Copper	0.36	0.20	0.05	0.27	0.09	0.08	0.02	0.025	0.21
Lead	0.029	0.04	0.23	0.008	0.016	<0.005	--	0.3	0.06
Nickel	0.06	<0.01	0.02	<0.05	<0.05	<0.05	--	--	<0.06
Zinc	0.49	0.37	0.30	0.29	0.11	0.07	--	0.16	0.35
Iron	1.03	0.64	0.25	0.53	2.13	0.44	0.1	0.2	0.80
Fluoride	1.0	0.40	1.6	0.2	--	1.6	0.05	0.8	0.86
Manganese	0.5	0.01	0.03	--	<0.05	0.01	0.1	--	0.21

a. EC = electrical conductivity in micromhos/cm.

Source: Metcalf & Eddy, 1975.

Proposed Treatment Levels

Level I-A

This proposed treatment process is commonly known as biological (or secondary) treatment and disinfection. There are several different biological treatment processes in common use, but this specific level of treatment assumes that the activated sludge process is utilized. The disinfection mode proposed by ESI is low dosage chlorination. (Alternative biological treatment and disinfection processes are discussed in the Alternatives section.) The process sequence is as follows: primary sedimentation, *carbonaceous oxidation* and disinfection (see Glossary for definition of terms). Effluent produced by this treatment process is of sufficient quality for ocean disposal through a deep outfall.

The level of total coliform organisms in this effluent (Table K-1) is relatively high because a low level of disinfection is utilized. This disinfection method is practiced because waste discharge requirements for deep ocean outfalls allow relatively large total coliform counts.

Level I-B

The level of I-B treatment process is essentially the same as I-A except a higher chlorine dosage is proposed in order to reduce the number of bacterial organisms remaining in the water. Wastewater treated to this level is also of sufficient quality to be discharged to the ocean.

Level II

The proposed Level II process includes biological (activated sludge) treatment, filtration and chlorine disinfection. The filtration is added to reduce suspended solids and biochemical oxygen demand in the effluent that would otherwise slow the infiltration/percolation disposal process proposed to follow Level II treatment. Filtration also slightly reduces the total nitrogen and phosphorous content of the effluent.

Level III

Level III treatment would add a nitrification step to the Level II process. The process sequence would therefore be as follows: primary sedimentation, carbonaceous oxidation, nitrification, filtration and disinfection. Nitrification is a biological process whereby ammonia is oxidized into nitrite and then nitrate by different groups of microorganisms. This is desirable in that unstable ammonia creates a relatively high biochemical oxygen demand in receiving waters and is toxic to fish in relatively low doses. Nitrate on the other hand is stable.

Nitrification can be achieved by increasing the water retention time in an activated sludge system and thoroughly aerating waste stream.

This treatment level is proposed for effluent discharge to the lower Salinas River, primarily when there are high natural flows in the river. Its use on a year-round basis is analyzed in the Impacts section of the EIS.

Level IV

Level IV is the conventional biological treatment system followed by a relatively high level of tertiary treatment. The primary sedimentation and carbonaceous oxidation of treatment Level I-B is followed by addition of a chemical coagulant (probably lime or alum) to reduce the suspended solids and BOD load of the wastewater. The coagulation is followed by secondary sedimentation, filtration and finally disinfection. In addition to reducing suspended solids and BOD, the total phosphorous content of the water is lowered.

This treatment level was designed by ESI to meet the public health requirements for wastewater reuse on food crops. The wastewater quality would be sufficient to allow either furrow or spray irrigation. No nitrification step is proposed because the wastewater would not be discharged to surface waters; therefore, ammonia toxicity would not be a problem.

Level V

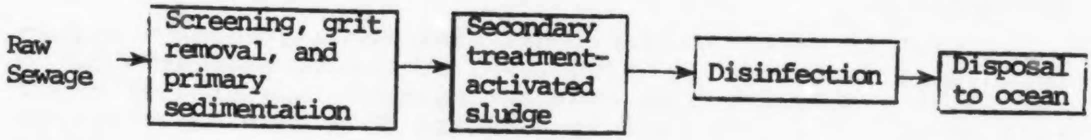
Treatment Level V is an advanced tertiary treatment system designed to reduce effluent toxicity and nutrients to the lowest levels possible. This will allow the wastewater to be discharged to surface waters at any time of the year. Biological treatment is followed by both nitrification and denitrification-chemical coagulation, secondary sedimentation, filtration and disinfection.

The nitrification step which follows the normal activated sludge treatment would be accomplished as described for Level III. This would be followed by denitrification which is simply the conversion of nitrate nitrogen to nitrogen gas. This is accomplished by adding a carbon source and subjecting the wastewater to anaerobic conditions where certain microorganisms utilize the carbon source in conversion of the nitrates. After the water is denitrified, a chemical coagulant is added to reduce suspended solids and phosphorous content; it is then settled, filtered and disinfected prior to disposal.

Alternative Project Treatment System Flow Charts

Alternative 1

Alternative 1 utilizes treatment Level I-A year-round for discharge to the ocean. This is sufficient treatment to meet state and federal requirements and reduce total coliform counts to acceptable levels. The process flow is diagrammed below.

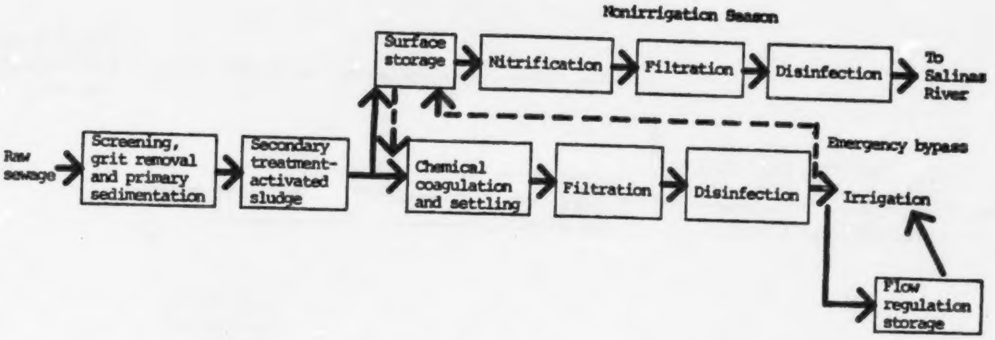

Raw Sewage
Screening, grit removal, and primary sedimentation
Secondary treatment-activated sludge
Disinfection
Disposal to ocean

Alternative 134

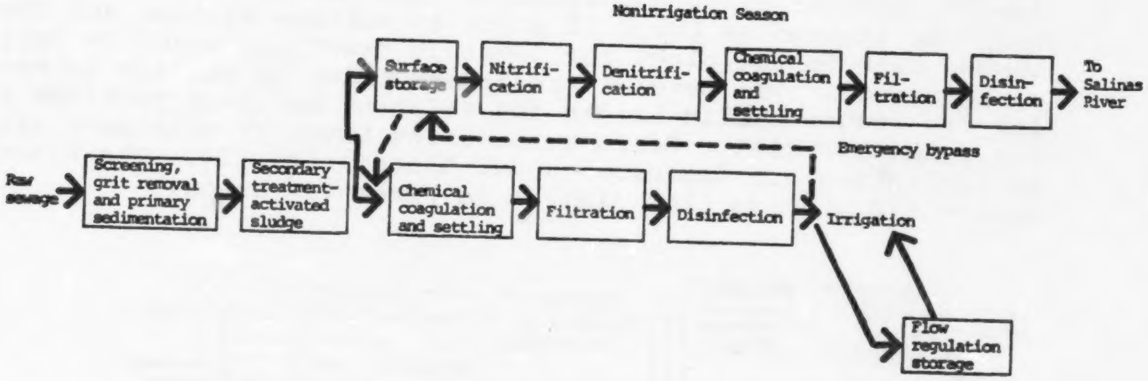
Several different treatment levels have been considered for use in Alternative 134. This combined irrigation reuse-lower Salinas River discharge option must satisfy both State Department of Health and RWQCB water quality standards for crop irrigation and surface water discharge. Effluent used for irrigation from April to October or November must be treated to Level IV. Treatment Level IV is required for crop irrigation because State Department of Health regulations (see Appendix L) specify spray-irrigated effluent, if used on food crops, must be "adequately disinfected, oxidized, coagulated, clarified, filtered wastewater" (Title 22, Section 60303 of the California Administrative Code). This reduces bacterial levels, suspended solids and turbidity to acceptable levels.

During the nonirrigation season or at times when irrigation demand is low and effluent must be discharged to the Salinas River, the treatment level would be III or V. The question of which level is appropriate and under what stream flow conditions is analyzed in part in this EIS (see Water Quality Impacts section). The two possible process flow diagrams are presented below.

Levels IV and III

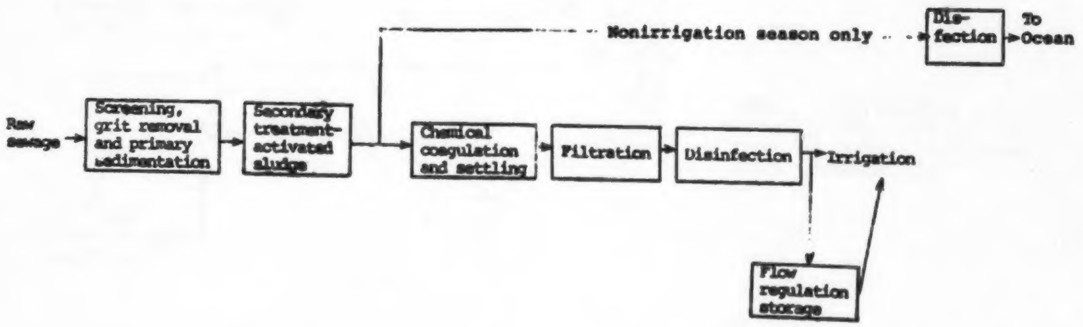

Nonirrigation Season
Raw sewage
Screening, grit removal and primary sedimentation
Secondary treatment-activated sludge
Surface storage
Nitrification
Filtration
Disinfection
To Salinas River
Emergency bypass
Chemical coagulation and settling
Filtration
Disinfection
Irrigation
Flow regulation storage

Levels IV and V


Nonirrigation Season
Raw sewage
Screening, grit removal and primary sedimentation
Secondary treatment-activated sludge
Surface storage
Nitrification
Denitrification
Chemical coagulation and settling
Filtration
Disinfection
To Salinas River
Emergency bypass
Chemical coagulation and settling
Filtration
Disinfection
Irrigation
Flow regulation storage

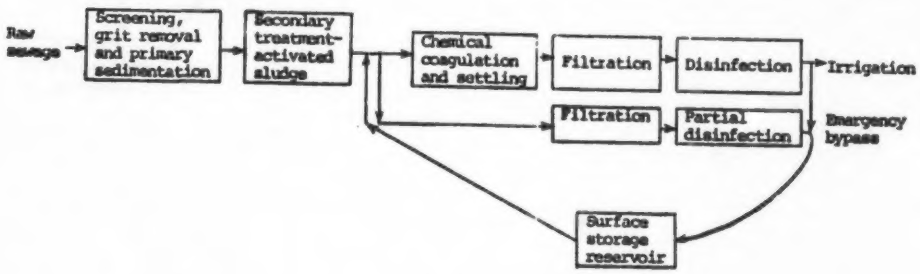
Alternative 166

This is the alternative recommended in the facilities plan. It includes use of treatment Level I-B for ocean disposal through a deep outfall during the nonirrigation season and use of Level IV for effluent destined for crop irrigation, usually from April to October.


Nonirrigation season only
Dis-fection
To Ocean
Raw sewage
Screening, grit removal and primary sedimentation
Secondary treatment-activated sludge
Chemical coagulation and settling
Filtration
Disinfection
Irrigation
Flow regulation storage

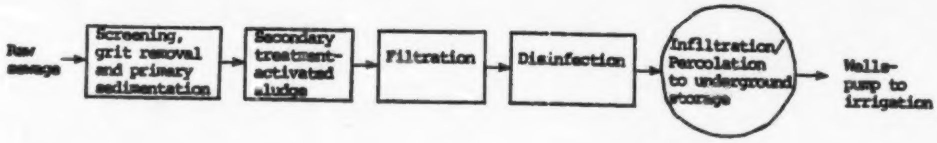
Alternative 170

Alternative 170 includes surface storage of wastewater as an interim step in the treatment process and would therefore involve several different stages of treatment. All wastewater would be treated to Level II prior to surface storage and then pumped back to the plant for Level IV treatment prior to irrigation reuse. The Level II treatment prior to storage is necessary to reduce public health and sediment build-up problems at the reservoir site. Reasons for using Level IV treatment prior to irrigation are discussed under Alternative 134. The Alternative 170 process flow diagram is presented below.


Raw sewage
Screening, grit removal and primary sedimentation
Secondary treatment-activated sludge
Chemical coagulation and settling
Filtration
Disinfection
Irrigation
Filtration
Partial disinfection
Emergency bypass
Surface storage reservoir

Alternative 171

Alternative 171 also involves intermediate storage of wastewater, but the storage is subsurface. The sandy soils of the proposed storage site are considered sufficient to provide an advanced level of treatment simply by percolating the wastewater to the subsurface. Therefore, only Level II treatment would be necessary prior to applying the wastewater to percolation/infiltration ponds. No additional treatment would be required after pumping up from underground storage; delivery would be made directly to the irrigation area. The process flow diagram is presented below.


Raw sewage
Screening, grit removal and primary sedimentation
Secondary treatment-activated sludge
Filtration
Disinfection
Infiltration/ Percolation to underground storage
Wells-pump to irrigation

APPENDIX L

PROPOSED AGRICULTURAL DEMONSTRATION PROJECT

FACILITIES PLAN FOR NORTH MONTEREY COUNTY

PROPOSED AGRICULTURAL IRRIGATION DEMONSTRATION PROGRAM

Prepared for

MONTEREY PENINSULA WATER POLLUTION
CONTROL AGENCY
Monterey County, California

19 March 1976

Prepared by

ENGINEERING-SCIENCE, INC.
600 Bancroft Way
Berkeley, California 94710

Source: Engineering Science, Inc., 1976c.

INTRODUCTION

During the last twelve months a large number of wastewater management alternatives for North Monterey County have been examined as part of the on-going facilities planning effort. A single alternative has now emerged as the most preferable course of action for the area; this alternative (designated Alternative 166 in the preceding analyses) involves treatment of wastewaters from Pacific Grove, Monterey, Seaside, Fort Ord, Salinas and Castroville at a 2-MGD facility near the mouth of the Salinas River with summertime crop irrigation with treated wastewater and wintertime disposal to the ocean.

Although the reclamation and crop irrigation element of the wastewater management system has many potential benefits, such as providing a means of ameliorating the Monterey Peninsula's water shortage many doubts remain in the minds of both public health agency officials and the farmers who might use the reclaimed water.

Because implementation of a wastewater management system as complex as the one proposed will take many years, it is both possible and desirable to stage its construction. Thus the opportunity exists to conduct an agricultural irrigation demonstration program, concurrent with other planning and design activities which would be designed to answer the questions that remain with respect to crop irrigation with reclaimed wastewaters.

OBJECTIVE

The program objective is to answer satisfactorily the following questions:

- Can food crops (such as lettuce and artichokes) with the normally expected quality (i.e., product safety for consumption as food without any restrictions) be grown using the reclaimed wastewaters generated in the Study Area?
- Will use of reclaimed wastewater result in any long-term deterioration of land quality, surface water quality or groundwater quality?
- Can reclaimed wastewater be used safely without hazard to farmworkers or consumers?

- Does use of reclaimed wastewater require any special agricultural management practices?
- Can the potential crop marketing problems be overcome?
- Will use of reclaimed water result in any significant economic impact due to decreased or increased production or changes in cropping patterns?

It should be noted that information emerging from the program would be to a considerable degree site-specific. The answers arrived at may hold only for this particular wastewater, soil type, crop type and agricultural practice.

A preliminary analysis indicates that it will be necessary to:

- grow crops commonly grown in the proposed reuse area on soils typically utilized and using treated wastewater;
- produce farm-scale crops, in addition to the small size replicate plots used in the quantitative trials, in order to establish feasibility of large-scale operations;
- provide a needed long-term perspective through successive production of the common crops for a number of successive years, estimated to be five years;
- analyze the edible parts of harvested crops for trace elements of concern and for pathogenic indicators as a means of ascertaining consumer safety from toxicological and pathogenic viewpoints:
- test soils and plant matter after irrigation for determination of earliest field reentry periods by testing for accumulation of viruses, bacteria and chemicals;
- sample and test waters leaching below the root zone for constituents which might pollute groundwater;
- sample crops and soils at random in various parts of Salinas Valley to test for bacteriological indicators as a check for the validity of the controls used and standards employed;
- determine, probably in the later years of the project, marketability of the harvested crops;

- provide farmers and operators in the potential reuse areas ample opportunity for access to and observation of the demonstration plots, test results and all other information developed during the course of the project;
- gain experience in the conduct of the demonstration project which would be useful for application to the conduct of the full-scale reclamation of the waters when eventually implemented; and
- establish guidelines for an economical and efficient monitoring system to be used in the future full-scale reclamation project.

TECHNICAL APPROACH

Well-established agricultural investigation techniques and methodologies would be applied in the demonstration project, with the necessary controls over the cultural practices so as to insure reliability and reproducibility of the results. Adequate replications (three or four, depending on soil uniformity) would be provided to determine satistical significance of the differences (if any) observed. Many of the cultural practices will be maintained constant for all plots and will represent typical farming practices locally employed by farmers as closely as possible. These practices will include fertilization; weed and pest control; irrigation methods, frequency and depth; soil preparation and cultivation; harvest, etc. The soil type would also be a constant, presumably a Pacheco clay loam, typical of most of the Castroville Irrigation Project area.

The independent variables which would be controlled are:

(1) Four irrigation water types

- Well water commonly used
- A high quality water (either trucked in from Nacimiento Reservoir or obtained from a local purveyor)
- Filtered secondary wastewater effluent from Castroville and/or from regional interceptor, until the regional plant is completed
- A reclaimed wastewater meeting the requirements of Title 22 of the California Administrative Code

(2) Two crops

- Artichokes
- Lettuce (red, romaine, head)

(3) Two nitrogen fertilizer application rates

The dependent variables which would be monitored, sampled, analyzed, measured and observed are:

(1) Yield of crops (tons per acre)

(2) Quality of crops for market (color, maturity, deficiency symptoms, shape, taste, shelf life and protein content)

(3) Plant tissue composition

- Nitrogen
- Phosphorus
- Potassium
- Boron
- Sulfur
- Zinc
- Cadmium
- Copper
- Nickel

(4) Pathogenic indicators on the crops' edible parts

- Total coliform
- Fecal coliform
- Viruses

(5) Reentry period after each irrigation by daily measurement of bacterial die-off in soils and plants

(6) Quality of waters leaching below the root zone

- Nitrate
- Total dissolved solids

- Hardness
- Boron

(7) Heavy metals accumulation in soil (water-soluble and total)

- Zinc
- Cadmium
- Copper
- Nickel

(8) Mass balance on total salts and individual elements of special concern

(9) Soil permeability and infiltration rate before and during the program

(10) Periodic medical check-ups of farm workers and program personnel for toxicological and dermatological disorder symptoms

PROTOCOL, PROCEDURES AND EQUIPMENT

The detailed design of the program would be conducted in consultation with members of the academic community whose recent intensive involvement with studies of heavy metals accumulation, nitrate movement and pathogen survival can be of value in making the demonstration project most effective. The Monterey County Farm Advisor would be consulted, as necessary, on farming practices. Furthermore, the involvement of various regulatory agencies--EPA, CSWRCB, State Health Department, County Health Department, etc.--will be sought at the planning stages of the demonstration project, and these agencies will be kept informed of interim results and work progress.

It is envisioned that the demonstration program will be conducted simultaneously in two different parts, in order to maximize achievement of the objectives enumerated above. In one set of relatively small plots (each measureing approximately 50 by 100 feet), the variables of interest will be replicated in a manner that will permit valid statistical analysis of quantitative results (chemical composition of plant parts and soil, yields, microbiological contamination, etc.). In another, larger field, the crops commonly grown in the Study Area will be grown, on a relatively large scale, using the effluent most likely produced by the eventual treatment plant. This larger field will be of importance in providing and fine-tuning operational guidelines, monitoring needs and controls. It will also provide, after the first few years, clues to any possible variations in crop quality, maturity and marketability. It can be used as an example for prospective users of reclaimed water who may wish to see the results first-hand in their own neighborhood.

Site Selection and Preparation

It will be of importance to select a site where the crops proposed for the demonstration project are commonly grown, on a soil that is typical of most of the area and is uniform in depth, slope, surface texture and profile characteristics. It is envisioned that a suitable (20- to 40-acre) field will either be leased for an extended period (probably a minimum of five years) or simply be contracted for the agricultural operations and testing requirements under direct supervision of the Monterey Peninsula Water Pollution Control Agency.

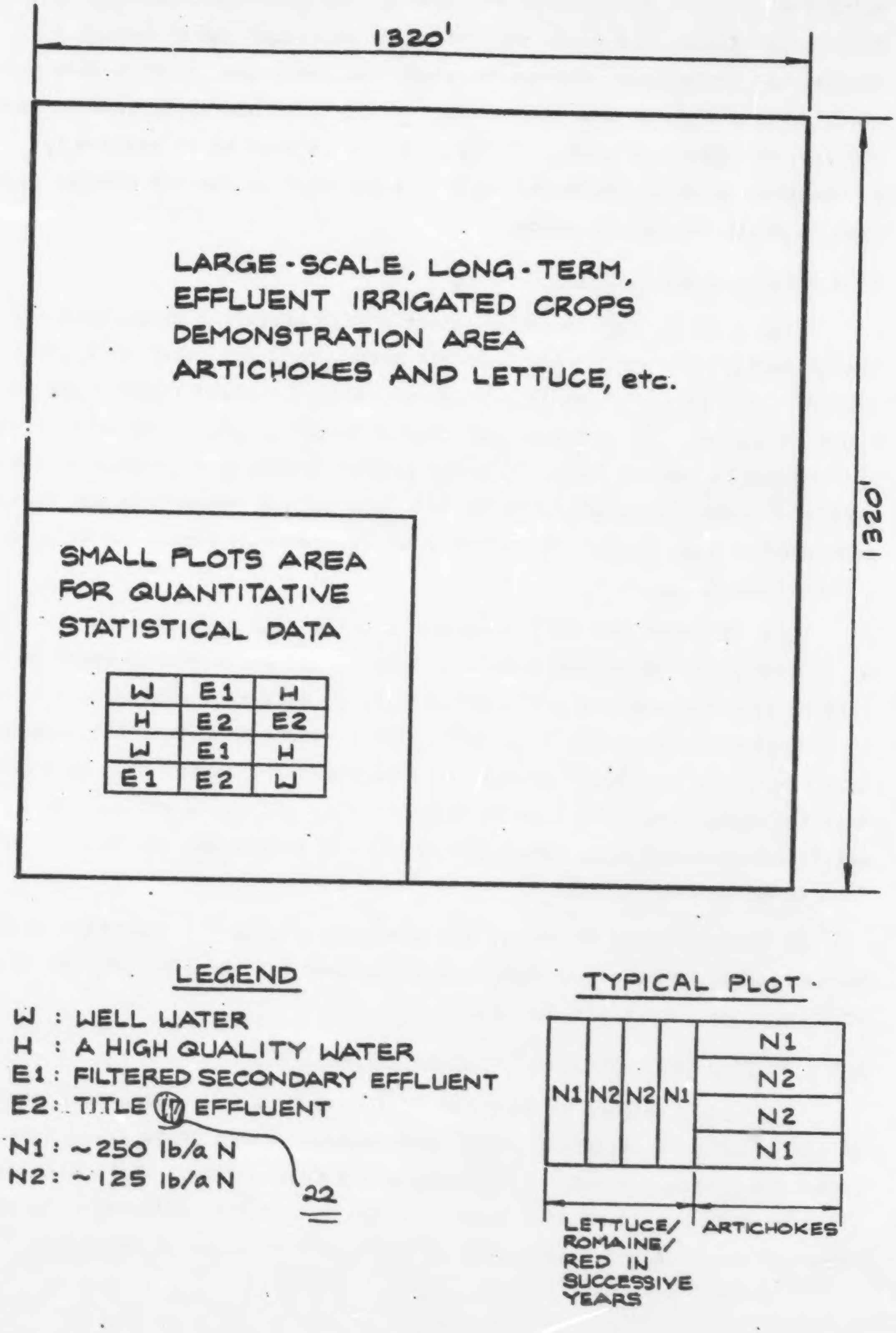
After the site has been selected, a field soil investigation involving hand-auger profiles at 100-foot grid corners and surface soil sampling (for texture, pH, organic content, permeability at different depths, color) will be conducted to determine soil uniformity or variations over the demonstration area. (It is expected that the demonstration program will be conducted entirely on Pacheco clay loam or Pacheco silty clay loam soils.) Heavy metals concentrations in soil samples will be determined in order to establish baseline conditions.

In the following sections, the plots designated for quantitative information gathering are described, and mechanisms for transfer and application of irrigation waters are discussed.

Water Source, Crop Type and Fertilizer Trial Plots

Specially designed trial plots will be set up for a five-year study of the effects of reclaimed water upon commonly grown crops in an area between the proposed treatment plant site and Castroville. The number of plots used is dependent upon available budget and soil uniformity in the selected site. A possible layout of the plots is shown on Figure 1.

FIGURE 1


1320'
1320'
LARGE-SCALE, LONG-TERM, EFFLUENT IRRIGATED CROPS DEMONSTRATION AREA ARTICHOKES AND LETTUCE, etc.
SMALL PLOTS AREA FOR QUANTITATIVE STATISTICAL DATA
W E1 H
H E2 E2
W E1 H
E1 E2 W
LEGEND
W : WELL WATER
H : A HIGH QUALITY WATER
E1 : FILTERED SECONDARY EFFLUENT
E2 : TITLE (17) EFFLUENT
N1 : ~250 lb/a N
N2 : ~125 lb/a N
22
TYPICAL PLOT
N1 N2 N2 N1
N1
N2
N2
N1
LETTUCE/ ROMAINE/ RED IN SUCCESSIVE YEARS
ARTICHOKES

Water Requirements

The four water types enumerated above will be supplied through (1) pumping from a well on or near the selected site; (2) trucking from the Salinas River and storage onsite; and (3) adding pilot treatment plants to the regional interceptor and eventually to the regional treatment plant conveying treated effluent.

It is estimated that approximately 80 acre-ft of reclaimed effluent will be needed during the seven-month irrigation season (an average of 18 inches for artichokes and 30 inches for other crops, each growing on about 20 acres). Over the seven-month irrigation season, this amount of effluent will be equal to an average of 125,000 gallons per day. The well water and the Salinas River waters will be needed to irrigate only three 50' x 100' plots, resulting in a maximum requirement of 0.86 acre-ft (281,000 gallons) through the irrigation season.

Irrigation Method

Artichokes are commonly irrigated by sprinklers in the Castroville area. Lettuce, on the other hand, is furrow irrigated. It would be most convenient for the demonstration program if the entire area were irrigated using the same irrigation method. For several reasons, the preferred method would be furrow irrigation. However, in the interest of maintaining flexibility and providing conditions that are similar to those that the farmers commonly encounter, it would be possible to use both methods. Adequate provisions against drift of sprinkled waters from one set of plots onto another would be necessary. Such provisions might include wide plot separation, physical barriers, use of low-pressure, large droplet nozzles and irrigation during night time, etc.

Methods of Analysis

Soils, edible plant tissues and percolating waters would be sampled with the computed frequency, replications and judicious sampling site and time selection necessary to minimize bias and maximize precision. Samples will be sent immediately to ES's Berkeley laboratory where they would be subjected to preservation, preparation and analysis techniques. All physical, chemical and the bulk of the biological test will be conducted at the ES Berkeley laboratory. Specialized virological examinations will be referred to a qualified laboratory for determination of total virus concentrations (plaque-forming units) in soils and on plant leaves. Coliform tests will be initiated in the field immediately upon sampling by inoculating the membrane filter. Samples will be carried to the ES Monterey office for completion of the analysis.

Soil analyses will be conducted in accordance with applicable methods published by the American Society of Agronomy. Water analyses will be performed as prescribed by *Standard Methods*.

Analyses for heavy metals (Zn, Cd, Ca, Ni) concentrations in the soil samples will be performed on two separate extracts of the samples; one obtained with 0.01N $Ca(NO_3)_2$ or 0.01N Ca Cl_2 solution, to represent the water soluble fraction (i.e., that available for plant uptake) of the heavy metals; and the other extracted with DTPA to represent total metals in the soil.

Plant tissues will be digested and examined for the total amounts of metals (Zn, Cd, Cu and Ni) present. Care will be taken to eliminate or compensate for the undesirable matrix effects caused by the relatively large amounts of soluble and insoluble solids present in samples of this type.

APPENDIX M

PROPOSED PROJECT COST DATA

Table M-1*

COST ESTIMATES FOR STAGE II

Cost Component	Estimated Cost, $[1]
Interceptors	
Monterey to Seaside	493,000
Seaside to Fort Ord	1,725,000
Fort Ord to Reservation Road	1,742,000
Marina to Reservation Road	225,000
Reservation Road to Regional Plant	1,747,000
Salinas to Regional Plant	3,840,000
Castroville to Regional Plant	1,042,000
Subtotal	10,824,000
Pumping Plants	
Monterey P.S.	
Structure	-
Pumps and Equipment	825,000
Seaside P.S. #1	
Structure	470,400
Pumps and Equipment	873,600
Seaside P.S. #2	
Structure	470,400
Pumps and Equipment	873,600
Marina P.S. #1	
Structure	-
Pumps and Equipment	116,000
Marina P.S. #2	
Structure	-
Pumps and Equipment	100,000
Reservation Road P.S.	
Structure	501,760
Pumps and Equipment	1,066,240
Salinas P.S.	
Structure	-
Pumps and Equipment	1,600,000
Castroville P.S. #1	
Structure	448,000
Pumps and Equipment	448,000
Castroville P.S. #2	
Structure	224,000
Pumps and Equipment	224,000
Subtotal	7,793,000
Outfall	
Land Portion	2,840,000
Ocean Portion	5,250,000
Subtotal	8,090,000
TOTAL	26,707,000

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(1) Costs as of 1 January 1976.

* Source: Engineering Science, Inc., 1976d.

Table M-2*

COST ESTIMATES FOR STAGE III

Cost Component	Estimated Cost, $(1)
Regional Secondary Treatment Plant	
Comminute and Grit Chamber	
Structure	296,600
Equipment	1,323,700
Primary Clarifiers	
Structure	1,979,600
Equipment	4,122,700
Aeration Basin	
Structure	1,719,000
Equipment	1,927,300
Chlorination-Dechlorination Basin	
Structure	767,900
Equipment	273,600
Sludge Thickener	
Structure	85,500
Equipment	915,200
Sludge Dewatering	
Structure	340,800
Equipment	1,777,800
Secondary Clarifiers	
Structure	2,180,000
Equipment	3,912,500
Sludge Digestors	
Structure	2,166,400
Equipment	1,689,000
Control Building	492,700
Pilot Plant	286,500
Demolition	2,000,000
TOTAL	28,256,800

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(1) Costs as of 1 January 1976.

* Source: Engineering Science, Inc., 1976d.

Table M-3+

FORM 7a

ANNUAL REVENUE NEEDED - INDUSTRIAL

MUNICIPALITY Stage II - Monterey Peninsula WPCA DATE 30 September 1976

FIRST FULL YEAR OF OPERATION 1982/83

A Number of Users	B Industrial Groups or Single Industrial Users	C SIC Group No.	D Capital Cost Grant Funded C_{gf}	E Capital Cost Non-Grant Funded C_{nf}	F Total Capital Cost C_{tc}	G Int. Cost	G-1 I/I Dist.	H Capital Cost Grant Funded Interceptor Outfall C_{io}	I O & M Cost First Full Year Operation C_l	J Gen. Administration & Accounting Cost C_a	K Total Annual Revenue Needed R_n*	L Average Revenue Needed R_{na}
1	Artichoke Industries	20	913	236	1,149	766	230	45	1,782	2.40	4,768	4,768
1	Pacific Foods	20	2,186	553	2,740	1,826	549	86	4,129	2.40	11,198	11,198
1	Salinas Tallow Works	20	10,465	2,642	13,108	8,737	2,628	426	19,462	2.40	53,236	53,236
1	Peter Paul, Inc.	20	9,369	2,257	11,626	7,750	2,331	86	18,173	2.40	47,962	47,962
1	J.M. Smuckers, Inc.	20	2,965	731	3,696	2,464	741	82	5,506	2.40	14,989	14,989
1	Distron, Inc.	20	1,982	482	2,464	1,642	494	37	3,486	2.40	9,750	9,750
6	SUB TOTALS		27,880	6,901	34,783	23,185	6,973	762	52,538	14	141,903	141,903

RATIO 0.651997

* --Includes Infiltration/Inflow capital cost distribution and a 20 percent increase to cover the costs of facilities cost equalization program.

+ Source: Engineering Science, Inc., 1976.

Table M-4*

FORM 7b

ANNUAL REVENUE NEEDED – NON-INDUSTRIAL

MUNICIPALITY Stage II - Monterey Peninsula WRCA DATE 30 September 1976

FIRST FULL YEAR OF OPERATION 1982/83

A Number of Users	B Commercial, Residential and Special Groups		D Capital Cost Grant Funded C_{gf}	E Capital Cost Non-Grant Funded C_{nf}	F Total Capital Cost C_{tc}	G Interest Cost I_c	H I/I Dist.	I O & M Cost First Full Year Operation C_t	J Gen. Administration & Accounting Cost C_3	K Total Annual Revenue Needed R_n 1	L Average Revenue Needed R_{na}
44,200	Single Family Residence		431,940	119,930	551,871	367,863	110,629	775,485	106,080	2,294,314	52
21,700	Multi-Family Residence		122,665	34,059	156,724	104,468	31,417	220,391	52,080	678,096	31
2,500	Mobile Homes		11,634	3,228	14,863	9,907	2,979	20,767	6,000	65,419	26
7,000	Hotel/Motel Rooms		27,289	7,626	34,915	23,273	6,999	31,266	16,800	135,904	19
2,131	General Commercial Offices		17,578	4,882	22,461	14,972	4,503	31,937	5,114	94,784	44
1,363	Retail Store/Groceries		5,616	1,559	7,175	4,783	1,438	10,142	3,271	32,171	24
289	Medical/Dental Offices		4,826	1,338	6,165	4,109	1,236	8,566	694	24,924	86
365	Cafe/Restaurant/Bars		30,194	8,383	38,578	25,715	7,733	54,262	876	152,597	418
273	Service Station/Garages		5,405	1,501	6,907	4,604	1,385	9,810	655	28,033	103
175	Barber/Beauty Shops		1,192	329	1,522	1,014	305	2,200	420	6,553	37
72	Laundry/Cleaners		14,886	4,133	19,020	12,678	3,813	26,915	173	75,119	1,043
190	Light Industry		2,383	660	3,044	2,029	610	4,283	456	12,506	66
96	Churches		2,018	559	2,577	1,717	517	3,516	230	10,268	107
23	Rest Home/Convalescent Hosp.		1,902	527	2,430	1,619	487	3,516	55	9,728	423
5	General Hospital		1,056	292	1,349	899	270	1,793	12	5,188	1,038
72	Public Schools		45,765	12,698	58,463	38,970	11,720	60,895	173	204,265	2,837
17	Animal Hospital/Boarding		250	69	319	213	64	478	41	1,338	79
14	Bakeries		365	101	466	311	93	695	34	1,919	137
14	Theaters		825	229	1,055	703	211	1,651	34	4,385	313
15	Car Wash		651	179	831	553	167	1,173	36	3,312	221
4	Bowling		250	69	319	213	64	478	10	1,301	325
64	Warehouse/Lumber		961	266	1,227	818	246	1,722	154	5,000	78
7	Bottling Works		2,903	805	3,709	472	744	5,310	17	14,702	2,100
	SUB TOTALS 7b		732,554	203,422	935,990	623,903	187,630	1,277,251	193,415	3,861,826	
	SUB TOTALS FROM FORM 7a		27,880	6,901	34,783	23,185	6,973	52,538	14	141,903	
	SPECIAL CLASSIFICATIONS										
	INFILTRATION/INFLOW 2		115,070	50,919	165,990	110,645	0	0			
	FUTURE CAPACITY		190,574	52,911	243,486	162,301	48,810	0		545,516	
3	FEDERAL FACILITIES		143,631	39,878	183,509	0	36,787	261,203	8	489,003 3	
	SUB TOTALS		449,275	143,708	592,985	296,131	85,597	261,203	8	1,176,419	
	TOTALS		1,209,709	354,031	1,563,758	920,934	280,200	1,590,992	193,437	5,038,245	

RATIO 0.666575

1 - Includes Infiltration/Inflow capital cost distribution and a 20 percent increase to cover the cost of a facilities cost equalization program.
2 - Total of Infiltration/Inflow costs in columns F and G is reallocated in column H to all users.
3 - Costs for Fort Ord are not increased by 20 percent for facilities cost equalization program.

* Source: Engineering Science, Inc., 1976.

Table M-4*

FORM 7b

ANNUAL REVENUE NEEDED – NON-INDUSTRIAL

MUNICIPALITY Stage II - Monterey Peninsula WRCA DATE 30 September 1976

FIRST FULL YEAR OF OPERATION 1982/83

A Number of Users	B Commercial, Residential and Special Groups		D Capital Cost Grant Funded C_{gi}	E Capital Cost Non-Grant Funded C_{ni}	F Total Capital Cost C_{tc}	G Interest Cost I_c	H I/I Dist.	I O & M Cost First Full Year Operation C_t	J Gen. Administratio & Accounting Cost C_3	K Total Annual Revenue Needed R_n 1	L Average Revenue Needed R_{na}
44,200	Single Family Residence		431,940	119,930	551,871	367,863	110,629	775,485	106,080	2,294,314	52
21,700	Multi-Family Residence		122,665	34,059	156,724	104,468	31,417	220,391	52,080	678,096	31
2,500	Mobile Homes		11,634	3,228	14,863	9,907	2,979	20,767	6,000	65,419	26
7,000	Hotel/Motel Rooms		27,289	7,626	34,915	23,273	6,999	31,266	16,800	135,904	19
2,131	General Commercial Offices		17,578	4,882	22,461	14,972	4,503	31,937	5,114	94,784	44
1,363	Retail Store/Groceries		5,616	1,559	7,175	4,783	1,438	10,142	3,271	32,171	24
289	Medical/Dental Offices		4,826	1,338	6,165	4,109	1,236	8,566	694	24,924	86
365	Cafe/Restaurant/Bars		30,194	8,383	38,578	25,715	7,733	54,262	876	152,597	418
273	Service Station/Garages		5,405	1,501	6,907	4,604	1,385	9,810	655	28,033	103
175	Barber/Beauty Shops		1,192	329	1,522	1,014	305	2,200	420	6,553	37
72	Laundry/Cleaners		14,886	4,133	19,020	12,678	3,813	26,915	173	75,119	1,043
190	Light Industry		2,383	660	3,044	2,029	610	4,283	456	12,506	66
96	Churches		2,018	559	2,577	1,717	517	3,516	230	10,268	107
23	Rest Home/Convalescent Hosp.		1,902	527	2,430	1,619	487	3,516	55	9,728	423
5	General Hospital		1,056	292	1,349	899	270	1,793	12	5,188	1,038
72	Public Schools		45,765	12,698	58,463	38,970	11,720	60,895	173	204,265	2,837
17	Animal Hospital/Boarding		250	69	319	213	64	478	41	1,338	79
14	Bakeries		365	101	466	311	93	695	34	1,919	137
14	Theaters		825	229	1,055	703	211	1,651	34	4,385	313
15	Car Wash		651	179	831	553	167	1,173	36	3,312	221
4	Bowling		250	69	319	213	64	478	10	1,301	325
64	Warehouse/Lumber		961	266	1,227	818	246	1,722	154	5,000	78
7	Bottling Works		2,903	805	3,709	472	744	5,310	17	14,702	2,100
	SUB TOTALS 7b		732,554	203,422	935,990	623,903	187,630	1,277,251	193,415	3,861,826	
	SUB TOTALS FROM FORM 7a		27,880	6,901	34,783	23,185	6,973	52,538	14	141,903	
	SPECIAL CLASSIFICATIONS										
	INFILTRATION/INFLOW [2]		115,070	50,919	165,990	110,645	0	0			
	FUTURE CAPACITY		190,574	52,911	243,486	162,301	48,810	0		545,516	
3	FEDERAL FACILITIES		143,631	39,878	183,509	0	36,787	261,203	8	489,003[3]	
	SUB TOTALS		449,275	143,708	592,985	296,131	85,597	261,203	8	1,176,419	
	TOTALS		1,209,709	354,031	1,563,758	920,934	280,200	1,590,992	193,437	5,038,245	

RATIO 0.666575

1 - Includes Infiltration/Inflow capital cost distribution and a 20 percent increase to cover the cost of a facilities cost equalization program.
2 - Total of Infiltration/Inflow costs in columns F and G is reallocated in column H to all users.
3 - Costs for Fort Ord are not increased by 20 percent for facilities cost equalization program.

* Source: Engineering Science, Inc., 1976.

Table M-5

DETAILED COST ESTIMATES FOR ALTERNATIVES

Alternative Number	Conveyance ($ x 106)				Conveyance ($ x 106)				Conveyance ($ x 106)				Totals ($ x 10^6)	
	Construction				Construction				Construction					
	Capital	Present Worth	Salvage Value[1]	PW O&M[2]	Capital	Present Worth	Salvage Value[1]	PW O&M[2]	Capital	Present Worth	Salvage Value[1]	PW O&M[2]	Total Capital	Total Present Worth[1]
1	17.72	13.51	-2.56	3.49	28.00	19.96	-2.74	19.05	8.09	6.17	-1.46	.15	53.81	55.57
166	17.72	13.51	-2.56	3.49	37.00	24.53	-4.20	19.98	9.94	7.11	-1.87	.12	64.66	60.11
170	17.72	13.51	-2.56	3.49	41.48	28.03	-4.47	21.91	22.76	15.77	-5.02	.56	81.96	71.22
171	17.72	13.51	-2.56	3.49	28.00	19.96	-2.74	19.65	5.81	3.52	-1.92	.60	51.53	53.51
134	17.72	13.51	-2.56	3.49	45.43	31.02	-4.87	24.22	6.24	4.17	-1.34	.40	69.39	68.04

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[1] 1996 present worth.

[2] 20-year present worth.

PUBLIC AGENCY GUIDELINES -- REGULATIONS

APPENDIX N

EPA-SWRCB WATER QUALITY CONTROL PLANS, GUIDELINES, RECOMMENDATIONS

CENTRAL COASTAL WATER QUALITY CONTROL PLAN
REPORT RECOMMENDATIONS*

Salinas River Sub-Basin

The extensive Salinas River Sub-basin includes the Monterey Peninsula and southern coastal area of Monterey Bay, the City of Salinas, agricultural and small urban centers of the Salinas Valley, and recreational developments in the upper watersheds.

Monterey Peninsula-Salinas Region

The implementation plan for the Monterey Peninsula-Salinas area calls for consolidation of Monterey Peninsula, Salinas, and Castroville area municipal wastewater flows with construction of a regional treatment plant and outfall facility for discharge to Central Monterey Bay with reuse of reclaimed wastewater for crop irrigation and possible enhancement of the lower Salinas River.

Staging can be accomplished in various ways; major elements of a staged program include:

1. Construct pumping station and interceptor sewer from Pacific Grove to the City of Monterey treatment plant during 1975. Enlarge and upgrade the Monterey facility to provide level II treatment during 1975 and abandon the existing Pacific Grove treatment plant. Discharge combined effluent flow through the existing Monterey outfall facility as an interim measure. Should reclamation be desired at Pacific Grove for such uses as golf course irrigation, a separate reclamation facility could be built for this purpose for treatment of wastewater flows diverted from the interceptor as demands for reclaimed water warrant.

2. Conduct further oceanography and marine biology studies during 1975 pertaining to a Central Monterey Bay outfall to be located somewhere near the mouth of the Salinas River.

3. Construct an interceptor sewer from Monterey through Seaside, Fort Ord, and Marina to a point near the Salinas River mouth consistent with the outfall alignment by 1977. Provide for local reclamation as justified by local needs.

4. Construct interceptor sewer from Salinas to the Monterey Bay shore consistent with the outfall alignment by 1977. Provide for local reclamation as justified by local needs.

5. Construct outfall into Central Monterey Bay from a point near the mouth of the Salinas River by 1977; outfall size should be sufficient to transport future wastewater flows from the Monterey Peninsula, Salinas and Castroville areas.

6. Convey wastewater effluents from the Monterey Peninsula treatment plants in the interceptor for outfall discharge to Central Monterey Bay by 1977; convey wastewater effluents from the Salinas Municipal treatment plants to the outfall by 1977; consolidated flows are required to meet level II treatment standards. At present flows, this would eliminate about 10 mgd from five local outfall discharges to the south pocket of Monterey Bay and 6 mgd from direct discharges to the Salinas River.

7. Construct interceptor from Castroville to the outfall location after existing unsewered areas in the Castroville area, including Moss Landing, Oak Hills and Prunedale, are sewered. These unsewered areas should develop sewering programs consistent with future consolidation with Castroville and the Monterey Peninsula-Salinas plan; these sewerage programs should be identified in terms of sewerage feasibility reports by 1977.

8. Construct a regional wastewater treatment and /or reclamation facility to permit abandonment of existing municipal treatment plants; reclamation plant construction consistent with level VI treatment would be initiated in the first stage of the regional wastewater treatment facility construction if reclaimed water demand is established; otherwise regional facility construction should be limited to level II treatment processes with provision for future upgrading. Irrigation reuse on local crops may require level III or level IV treatment and demonstrations of such reuse should be initiated prior to 1977 to determine extent of acceptance in the local farming community and evaluate public health aspects of this program. Begin construction of regional treatment plant by 1977.

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* Source: California State Water Resources Control Board, 1975a.

Options are available in the program concerning the sequence of events and extent of consolidation to be achieved during the planning period; i.e., until the year 2000. For example, the timing for construction of interceptor sewers from the Monterey Peninsula or Salinas could be different; either can proceed first or construction can be concurrent. However, construction of the outfall must proceed with the first interceptor project, and the sizing of the outfall must be consistent with total future consolidation. In the Castroville area there are unsewered areas which may be sewered in the future; these facilities should be planned in harmony with the consolidation program. Sewerage feasibility studies should be performed to define more closely the staging of sewering of these areas and to relate sewer projects to future facility alignments. For example, Moss Landing should convey wastewaters southward for interim disposal to land or proceed directly toward consolidation with Castroville. Castroville may delay consolidation with Monterey-Salinas while sewerage facilities are being developed for areas to the north and east; however, land disposal is recommended for the Castroville area as an interim measure and for possible demonstration of irrigation reuse potential and to determine acceptance of such reuse to local farmers in this area. Elimination of discharge to Templedero Slough should be accomplished by 1976.

In the Salinas area the Gabilan Acres-Bolsa Knolls area should be tied in with the City of Salinas system, and the Toro Park plant should be abandoned by 1977 and wastewaters from this area should be conveyed to Salinas. A further consideration for Salinas is the possible retention of the industrial treatment facility which would avoid sizing interceptors for seasonal peak flows from seasonal wastes generated by processors of agricultural crops; long-term retention of the industrial waste facility should be evaluated at the project report level in terms of cost-effective aspects as well as impact on reclamation, both locally and on the reclamation features of the consolidation plan. Mineral quality and the timing of peak industrial flows which coincide with harvest periods may be incompatible with reclamation for irrigation reuse near Castroville. Although this facility could be retained, the discharge of industrial wastes to the regional interceptor system during peak periods could be accommodated.

In the Monterey area, the existing Monterey Peninsula Water Pollution Control Agency (MPWPCA) or a newly formed sanitation district could include Castroville CSD, Marina CWD, the City of Monterey, the City of Pacific Grove, Seaside CSD, and the City of Salinas as participating agencies. It is recommended that the tri-cities group (Monterey, Seaside and Pacific Grove) get together with Fort Ord, Marina, Salinas, and Castroville to decide on the character of the implementing agency and establish working arrangements for early aspects in the staging of the implementation plan, such as ocean outfall studies and irrigation reuse demonstrations. Joint powers agreements could be used initially; however, a management agency is envisioned which would have broader financing powers.

The discharge of wastes which do not comply with the following conditions are prohibited:

1. Wastes discharged to surface waters shall be essentially free of toxic substances, grease, oil, and phenolic compounds.
2. Wastes discharged to groundwaters shall be free of toxic substances in excess of accepted drinking water standards; taste, odor, or color producing substances and nitrogenous compounds in quantities which could result in a groundwater nitrate concentration above 45 mg/l.
3. Waste discharges shall not contain materials in concentrations which are hazardous to human, plant, animal, or aquatic life.

The discharge of elevated temperature wastes in excess of the liquids specified in Chapter 4 Water Quality Objectives into COLD intrastate waters is prohibited.

The discharge of soil, silt, bark, slash, sawdust or other organic and earthen materials from any logging, construction, or associated activity of whatever nature into any stream in the basin in quantities deleterious to fish, wildlife, and other beneficial uses is prohibited.

The placing or disposal of soil, silt, bark, slash, sawdust or other organic and earthen materials from any logging, construction, or associated activity of whatever nature at locations above the anticipated high-water line of any stream in the basin where they may be washed into said waters by rainfall or runoff in quantities deleterious to fish, wildlife and other beneficial uses is prohibited.

Wasters Subject to Tidal Action. Waste discharges to the following areas are prohibited:

1. Effective July 1, 1977, in Monterey Bay, northern and southern extremes within the following areas: inshore from a line extending from Santa Cruz Point to the mouth of the Pajaro River; and inshore from a line extending from Point Pinos to the mouth of the Salinas River; and the offshore area within a three-mile radius of Point Pinos.
2. Carmel Bay, within 1000 feet from the Point Lobos Preserve of the State Department of Parks and Recreations, as recorded in 1970.
3. Tidal waters within 1000 feet of the coast and 100-foot depth contour, measured from mean low water. An exception to this prohibition may be allowed by the Board in prescribing waste discharge requirements after finding that all beneficial water uses will otherwise be protected.

The discharge of any radiological, chemical, or biological warfare agent or high level radioactive waste into the ocean is prohibited.

The discharge of wastes into Areas of Special Biological Significance or close enough to such areas to alter their natural water quality conditions is prohibited.

The discharge of municipal and industrial waste sludge and sludge digester supernatant directly to the ocean, or into a waste stream that discharges to the ocean without further treatment is prohibited.

The bypassing of untreated waste to the ocean is prohibited.

No person, whether engaged in commerce or otherwise, shall place, throw, deposit or discharge, or cause to be placed, thrown, deposited or discharged on or in tidal waters any untreated waste or waste matter, except vessel wash down water, from any vessel.

The discharge of oil or grease from other than natural sources which produces a visible or measurable effect to tidal waters of the basin is prohibited.

New thermal waste discharges to coastal waters, enclused bays and estuaries having a maximum temperature greater than 4°F above the natural temperature of the receiving water are prohibited.

Source: California State Water Resources Control Board, 1975a.

CENTRAL COASTAL WATER QUALITY CONTROL PLAN DISCHARGE PROHIBITIONS*

Discharge Prohibitions

Due to unique cultural, scenic, aesthetic, historical, scientific, and ecological values of the Central Coastal Basin, and the necessity to protect the public health and the desire to achieve water quality objectives, the Regional Water Quality Control Board has established certain discharge prohibition.

All Waters. The discharge of oil or any residual products of petroleum to the waters of the State, except in accordance with waste discharge requirements, or other provisions of Division 7 of the California Water Code is prohibited.

Inland Waters. Waste discharges to the following inland waters are prohibited:

1. All surface, fresh water impoundments and their immediate tributaries.
2. All surface waters within the San Lorenzo River, Aptos-Soquel, and San Antonio Creek Sub-basins and all water contact recreation areas located in fresh waters except where benefits can be realized from direct discharge of reclaimed water.
3. All dead end sloughs receiving little flushing action from land drainage or natural runoff.
4. All coastal surface streams and natural drainage ways that flow directly to the ocean within the Santa Cruz Coastal, Monterey Coastal, San Luis Obispo Coastal from the Monterey county line to the northern boundary of San Luis Obispo Creek drainage, and the Santa Barbara Coastal Subbasins except where discharge is associated with an approved wastewater reclamation program.
5. The Santa Maria River downstream from the Highway 1 bridge.
6. The Santa Ynez River downstream from the salt water barrier.

In addition, discharge from individual sewage disposal systems, including but not limited to septic tank seepage pits and adsorption fields, cesspools, pit privies, chemical toilets, etc., is prohibited:

1. On all parcels of land within the projected horizontal distance of 200 feet of all reservoirs and impoundments as determined by the spillway elevation.
2. Within a reservoir watershed, on individual parcels of land of less than 2.5 acres beyond the projected horizontal distance of 200 feet from the high water elevation of reservoirs and impoundments, as determined by the spillway elevation.
3. On individual parcels of land where any part of the disposal system is within a horizontal distance of 100 feet of surface streams, natural watercourses or domestic water supply wells.
4. On parcels of land less than 0.5 acres in new divisions of land not located on reservoir watersheds where depth of usable groundwater is less than 100 feet below ground surface unless sufficient engineering justification is provided to prove beneficial uses will be protected.

The discharge of solid waste materials is prohibited under the following conditions and/or in specific locations:

1. Any Class I solid waste material to any location other than Class I solid waste disposal site.
2. Any Class II solid waste materials to any location other than Class I or II solid waste disposal sites.
3. Solid wastes shall not be discharged to rivers, streams, creeks, or any natural drainage ways or flood plains of the foregoing.

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* Source: California State Water Resources Control Board, 1975a.

Table N-1

TREATMENT REQUIREMENTS FOR SELECTED DISPOSAL OPTIONS

Treatment level	Type of treatment	Treatment processes	Appropriate disposal option
I	Physical-chemical with disinfection[a]	Sedimentation with chemical addition, chlorination, dechlorination	Possible ocean discharge option where secondary treatment not cost-effective
II	Biological secondary with disinfection[a]	Sedimentation, carbonaceous oxidation, chlorination, dechlorination	Ocean discharge. Irrigation and/or percolation systems, where nitrate is not a problem in groundwater
III	Biological nitrification with disinfection	Sedimentation, biological oxidation with nitrification, chlorination, dechlorination	Discharge to streams where recreational use is restricted
IV	Biological nitrification, filtration with disinfection	Sedimentation, biological oxidation with nitrification, effluent filtration, chlorination, dechlorination	Discharge to streams where unrestricted recreational use occurs
V	Biological nitrification and denitrification with disinfection	Sedimentation, biological oxidation with nitrification, denitrification, chlorination	Irrigation and/or percolation systems where nitrate is a problem in groundwater
VI	Physical-chemical-biological with disinfection	Sedimentation with chemical addition, oxidation with nitrification, denitrification, effluent filtration, chlorination, dechlorination	Recreational impoundments or discharge where eutrophication is a problem
VII	Partial demineralization or lime soda softening of water supply plus biological nitrification and denitrification of wastewater with disinfection	Water supply - lime soda softening or partial demineralization. Wastewater - sedimentation, biological sedimentation, biological oxidation with nitrification, denitrification, chlorination	Spray irrigation and percolation systems where groundwater nitrate and TDS concentrations are a problem
VIII	Partial demineralization of wastewater, biological nitrification and denitrification with disinfection	Sedimentation, biological oxidation with nitrification, denitrification, effluent filtration, partial demineralization, chlorination	Spray irrigation and percolation systems where groundwater nitrate and TDS concentrations are a problem

[a] Deep water ocean discharges where the effluent field is normally submerged may not require continuous disinfection.

Source: California State Water Resources Control Board, 1975.

STATE WATER RESOURCES CONTROL BOARD POLICIES GUIDING DEVELOPMENT OF PROJECT ALTERNATIVES

1. Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California", October, 1969.
2. "Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California", May 18, 1972.
3. Resolution No. 72-45, "Water Quality Control Plan for Ocean Waters of California", July 6, 1972.
4. Resolution No. 74-73, "Water Quality Control Policy for the Enclosed Bays and Estuaries of California", May 16, 1974.
5. Resolution No. 75-21, "Approval of Water Quality Control Plans for the Central Coast Basin....", March 20, 1975.

Table N-2

BENEFICIAL USES OF WATERS WITHIN STUDY AREA*

	Municipal	Agricultural	Industrial Processing	Industrial Service	Groundwater Recharge	Water Contact Recreation	Non-Contact Recreation	Wildlife Habitat	Cold Freshwater Habitat	Warm Freshwater Habitat	Fish Migration	Fish Spawning	Marine Habitat	Shellfish Harvesting	Navigation	Ocean Commercial and Sport Fishing	Preservation of Rare and Endangered Species
Salinas River above Spreckels	x	x		x	x	x	x	x	x	x	x						
Salinas River below Spreckels							x	x		x	x						
Elkhorn Slough				x		x	x	x					x	x	x	x	x
Monterey Harbor				x		x	x						x	x	x	x	x
Coastal Water North of Salinas River				x		x	x						x	x	x	x	x
Coastal Water South of Salinas River				x		x	x						x	x	x	x	

Source: California State Water Resources Control Board, 1975.

Table N-3

WATER QUALITY CRITERIA FOR BENEFICIAL USES[a]

	MUNICIPAL		AGRICULTURE				INDUSTRIAL SERVICE[c]	RECREATION		WILDLIFE HABITAT		FRESHWATER AQUATIC LIFE			FISH MIGRATION	MARINE LIFE		SHELLFISH HARVESTING
			EPA		RWQCB[b]								RWQCB					
	EPA	RWQCB	Irrigation	Livest.	Irrigation	Livest.	RWQCB	RWQCB (Contact)	EPA	EPA	RWQCB	EPA*	Cold[d]	Warm	RWQCB	EPA	RWQCB[e]	RWQCB
Temperature	Not to detract from potability		No limit					30°C	86°F	Maintain natural levels	5°F above natural		5°F above natural	5°F above natural	5°F above natural	2.0 (0-5)[u] 1.0 (6-8)	5°F above natural	
Turbidity (JTU)	No limit	5/							Clarity-4 ft. Secchi		<10 or 10% above natural	<10% change in C.P.	<10 or 10% above natural	<10 or 10% above natural	<10 or 10% above natural		10% above natural	10% above natural
Suspended solids (mg/l)			No limit				3,000	30/100				80						
Total alkalinity (mg/l)	No limit									30-130	20	75% natural level	20	20	20			
Aluminum (mg/l)			5.0	5.0	5.0	5.0					0.1		0.1	0.1	0.1	0.01 x 96 hr LC_{50}[i]	0.1	0.1
Arsenic (mg/l)	0.1	0.10	0.10	0.2	0.1	0.2					0.01		0.01	0.01	0.01	0.05	0.01	0.01
Ammonia (mg/l)[f]	0.5										0.025	0.02	0.025	0.025	0.025	0.4	0.025	0.025
Barium (mg/l)	1.0	1.0									0.5		0.5	0.5	0.5	1.0	0.5	0.5
Beryllium (mg/l)		0.1/0.5	0.1	No limit	0.1											1.5		
Boron (mg/l)	1.0	1.0	0.75-2.0[h]	5.0	0.5/2.0											0.1 x 96 hr LC_{50}[i]		
Chloride (mg/l)	250	250/600	No limit		175/350		600											
Chlorine (mg/l)[g]			No limit								0.003	0.003[o]	0.003	0.003	0.003	0.01	0.003	0.003
Cadmium (mg/l)	0.01	0.01	0.01	50 µg/l	0.01	0.05					0.003	0.003[p]	0.03[t]	0.03[t]	0.003	0.01	0.0002	0.003
Chromium (mg/l)	0.05	0.05	0.1	1.0	0.10	1.0					0.05	0.03	0.05	0.05	0.05	0.1	0.05	0.01
Cobalt (mg/l)			0.05	1.0	0.05	1.0												
Carbon dioxide (mg/l)											15		15	15	15			
Copper (mg/l)	1	1.0/	0.20	0.5	0.2	0.5					0.01	0.10 x 96 hr LC_{50}[i]	0.03[t]	0.03[t]	0.01	0.05	0.01	0.01
Cyanide (mg/l)	0.2	0.2									0.005	0.05 x 96 hr LC_{50}[i]	0.005	0.005	0.005	0.01	0.005	0.005
Fluoride (mg/l)		0.8-1.7	2.0[j]		1.0	2.0					1.5		1.5	1.5	1.5	1.5	1.5	1.5
$CaCO_3$ (mg/l)		500/					850											
Iron (mg/l)	0.3	0.3	5.0	No limit	5.0						0.5		0.5	0.5	0.5	0.3	0.5	0.5
Lead (mg/l)	0.05	0.05	5.0	0.1	5.0	0.1					0.01	0.03	0.03	0.03	0.01	0.02 x 96 hr LC_{50}[i]	0.01	0.01
Lithium (mg/l)			2.5		2.5											0.05		
Manganese (mg/l)	0.05	0.05/	0.20	No limit	0.2	0.01					0.02		0.02	0.02	0.02	0.01	0.02	0.02
Mercury (inorg.) (mg/l)	0.002 total	0.005		0.001		0.01					0.001	0.0002[q]	0.0002[q]	0.0002[q]	0.001	0.1	0.0001	0.001
Molybdenum (mg/l)			0.01	No limit	0.01	0.5										0.05 x 96 hr LC_{50}[i]		
Nickel (mg/l)			0.2		0.2						0.002	0.02 x 96 hr LC_{50}[i]	0.4[t]	0.4[t]	0.002	0.1	0.002	0.002
$NO_3 + NO_2$ (mg/l as N)	10 NO_3 1 NO_2	10	No limit on NO_3	100 10 mg/l NO_2		100 10 NO_2							1.0					

	MUNICIPAL		AGRICULTURE				INDUSTRIAL SERVICE^{c}	RECREATION		WILDLIFE HABITAT		FRESHWATER AQUATIC LIFE			FISH MIGRATION	MARINE LIFE		SHELLFISH HARVESTING
			EPA		RWQCB^{b}								RWQCB					
	EPA	RWQCB	Irrigation	Livest.	Irrigation	Livest.	RWQCB	RWQCB (Contact)	EPA	EPA	RWQCB	EPA	Cold^{e}	Warm	RWQCB	EPA	RWQCB^{e}	RWQCB
pH (units)	5.0-9.0	6.5-8.3	4.5-9.0		6.5-8.3			6.5-8.3	5.0-9.0	6.0-9.0	7.0-9.2	6.0-9.0	7.0-8.5	7.0-8.5	6.5-8.5	6.5-8.5	7.0-8.5	7.0-8.5
Selenium (mg/l)	0.01	0.01	0.02	0.05	0.02	0.05					0.005		0.005	0.005	0.005	0.01	0.005	0.005
Silver (mg/l)	0.05	0.05									0.001		0.001	0.001	0.001	0.005	0.001	0.001
Sodium absorpt ratio					<6.0													
Sulfate (mg/l)	250	250/ 500					680											
Sulfide (mg/l)							1,000				0.002	0.002	0.002	0.002	0.002		0.002	0.002
TDS (mg/l)	No limit	500/ 1,500	500/1,000^{k}	3,000 soluble salts	700-2,000					No limit	10 ± natural for 24 hrs		1,500	1,500	1,500			
EC (micromhos)					<750						3,000		3,000	3,000	3,000			
Zinc (mg/l)	5	5/		25	2.0	25					0.02	0.003 x 96 hr LC_{50} ^{i}	0.2^{c}	0.2^{c}	0.02	0.1	0.02	0.02
Total coliform (per 100 ml)		100/ 10,000			5,000												1,000	70
Fecal coliform (per 100 ml)	2,000	20/ 2,000	1,000	1,000^{l}	1,000			200	2,000 avg. 4,000 max.	2,000								
Microorganisms (per 100 ml)	10,000			5,000^{l}						2,000								
Dissolved oxygen (mg/l)	No limit				2.0		75 COD				5.0	5.0-6.0^{f}	7.0	5.0	5.0	6.0	7.0 & 5.0^{f}	5.0
Total phosphorous (mg/l)	No limit							0.05	0.025-0.50^{m}				0.1	0.2		0.0001^{n}	0.2	
Total nitrogen (mg/l)								0.5					1.0	2.0			2.0	
MBAS (mg/l)		0.5						1.0-2.0										
Oil & grease (mg/l)		Virtually absent						0/5.0		No visible floating oils	0	No visible floating oils	0	0	0	No film, no on-shore oil deposit	None visible	
ABS (mg/l)	0.5										1.0		1.0	1.0	1.0		1.0	1.0
PCB's (mg/l)										No increase	0.0001	0.000002	0.0001	0.0001	0.0001		0.0001	0.0001
Pesticides										1 mg/kg DDT $_{w}$		0.01 x 96 hr LC_{50} ^{i}				0.01 x 96 hr LC_{50} ^{i}		

Source: Regional Water Quality Control Board, Central Coast Region, 1974 and 1974a; U. S. Environmental Protection Agency, 1973.

Footnotes for Table N-3

a RWQCB values shown are limiting concentrations unless otherwise specified; where two values appear (e.g., a/b) the first is the threshold value, the second is the short-term limit value. All single numers are limiting values. Limiting concentrations are suggested as 90 percentile limits, not to be violated by controllable factors more than 10 percent of the time. EPA values shown are maximum acceptable concentrations unless otherwise specified.

b Based primarily on National Academy of Sciences-National Academy of Engineers, Environmental Study Board ad hoc Committee on Water Quality Criteria; all values except boron and chloride are maximum acceptable concentrations.

c Cooling water requirements for fresh water once through.

d Includes preservation of rare and endangered species beneficial use.

e Includes ocean commercial and sport fishing beneficial use.

f Un-ionized or undissociated ammonia.

g Residual chlorine.

h .75 for sensitive crops; 1.0 for semi-tolerant; 2.0 for tolerant.

i LC_{50} is 50 percent lethal concentration using the most sensitive important species in the locality.

j 1.0 mg/l on sandy soil.

k For sensitive crops; 2,000-5,000 for tolerant crops.

l Coliforms; average of a minimum of 2 samples per month.

m 0.25 mg/l for lakes and reservoirs; .1 mg/l for streams; .05 mg/l at confluence.

n Maximum acceptable concentration in fish flesh.

o Chronic exposure; 0.05 mg/l for up to 30 minutes in any 24-hour period.

p In hard water (total hardness greater than 100 mg/l as $CaCO_3$); 0.04 mg/l in soft water.

q Total mercury; should not exceed 0.05 µg/l as an average value.

r 5.8 at 35°C and 6.8 at 1.5°C; varies with temperature between these extremes.

s For pesticides with no toxicity data; see Table F-3 for other pesticides.

t Hardwater (>100 mg/l $CaCO_3$) maximum; lesser amounts are acceptable for soft water (<100 mg/l $CaCO_3$)

u °C acceptable change; 9-5 is September to May and 6-8 is June to August.

v 7.0 is mean annual lowest concentration and 5.0 is lowest acceptable at any time.

w DDT insecticide limit, wet weight.

x Elemented phosphorous.

Table N-4

WATER QUALITY CRITERIA FOR MUNICIPAL USE: PESTICIDES, HERBICIDES, AND INSECTICIDES (MG/L)*

	Municipal Use		Freshwater Aquatic Use[c]
	RWQCB	EPA	RWQCB & EPA
	PESTICIDES		
Aldrin	0.017	0.001	.00001
Chlordane	0.003	0.003[a]	.00004
DDT	0.042	0.05	.000002
Dieldrin	0.017	0.001	.000005
Endrin	0.001	0.0005	.000002
Heptachlor	0.018	0.0001[b]	.00001
Heptachlor epoxide	0.018	0.0001	
Lindane	0.056	0.005	.00002
Methoxychlor	1.0	1.0[a]	.000005
Organophosphorous and Carbamate compounds (as parathion in cholinesterase inhibition)	0.1	0.1	
Toxaphene	0.005	0.005[a]	.00001
	HERBICIDES		
2, 4-D plus			
2, 4, 5-T plus			
2, 4, 5-TP	0.1		
2, 4-D		0.02	
	INSECTICIDES		
Diazinon			.000009
Dursban			.000001
Malathion			.000008
Parathion			.000001
TEPP			.0003
Carbaryl			.00002

* i.e., ppm.

[a] Adjusted for organoleptic effects.

[b] Adjusted for interconversion to H. epoxide.

[c] Recommended concentrations of insecticides and pesticides in whole (unfiltered) water sampled at any time and any place. Concentrations were determined by multiplying the acute toxicity values for the more sensitive species by an application factor of 0.01. Represents RWQCB salt water habitat standards also.

Source: Regional Water Quality Control Board, Central Coast Region, 1974a; U. S. Environmental Protection Agency, 1973.

Table N-5

FEDERAL SECONDARY TREATMENT EFFLUENT REQUIREMENTS

Parameter	Unit	Value	
		Monthly Average	Weekly Average
Biochemical Oxygen Demand (five day)	mg/l	30	45
Suspended Solids	mg/l	30	45
pH		6.0 to 9.0	

Source: Federal Register, Vol. 40, No. 159 - Friday, August 15, 1975.

APPENDIX O

CALIFORNIA DEPARTMENT OF HEALTH WASTEWATER RECLAMATION CRITERIA AND GUIDELINES

WASTEWATER
RECLAMATION CRITERIA

An Excerpt from the

CALIFORNIA ADMINISTRATIVE CODE
TITLE 22, DIVISION 4

ENVIRONMENTAL HEALTH

1975

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH
Water Sanitation Section
2151 Berkeley Way, Berkeley 94704

CHAPTER 4. RECLAMATION CRITERIA

Article 1. Definitions

60301. **Definitions.** (a) **Reclaimed Water.** Reclaimed water means water which, as a result of treatment of domestic wastewater, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.

(b) **Reclamation Plant.** Reclamation plant means an arrangement of devices, structures, equipment, processes and controls which produce a reclaimed water suitable for the intended reuse.

(c) **Regulatory Agency.** Regulatory agency means the California Regional Water Quality Control Board in whose jurisdiction the reclamation plant is located.

(d) **Direct Beneficial Use.** Direct beneficial use means the use of reclaimed water which has been transported from the point of production to the point of use without an intervening discharge to waters of the State.

(e) **Food Crops.** Food crops mean any crops intended for human consumption.

(f) **Spray Irrigation.** Spray irrigation means application of reclaimed water to crops by spraying it from orifices in piping.

(g) **Surface Irrigation.** Surface irrigation means application of reclaimed water by means other than spraying such that contact between the edible portion of any food crop and reclaimed water is prevented.

(h) **Restricted Recreational Impoundment.** A restricted recreational impoundment is a body of reclaimed water in which recreation is limited to fishing, boating, and other non-body-contact water recreation activities.

(i) **Nonrestricted Recreational Impoundment.** A nonrestricted recreational impoundment is an impoundment of reclaimed water in which no limitations are imposed on body-contact water sport activities.

(j) **Landscape Impoundment.** A landscape impoundment is a body of reclaimed water which is used for aesthetic enjoyment or which otherwise serves a function not intended to include public contact.

(k) **Approved Laboratory Methods.** Approved laboratory methods are those specified in the latest edition of "Standard Methods for the Examination of Water and Wastewater", prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation and which are conducted in laboratories approved by the State Department of Health.

(l) **Unit Process.** Unit process means an individual stage in the wastewater treatment sequence which performs a major single treatment operation.

(m) **Primary Effluent.** Primary effluent is the effluent from a wastewater treatment process which provides removal of sewage solids so that it contains not more than 0.5 milliliter per liter per hour of settleable solids as determined by an approved laboratory method.

(n) **Oxidized Wastewater.** Oxidized wastewater means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

(o) **Biological Treatment.** Biological treatment means methods of wastewater treatment in which bacterial or biochemical action is intensified as a means of producing an oxidized wastewater.

(p) **Secondary Sedimentation.** Secondary sedimentation means the removal by gravity of settleable solids remaining in the effluent after the biological treatment process.

(q) **Coagulated Wastewater.** Coagulated wastewater means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated by the addition of suitable floc-forming chemicals or by an equally effective method.

(r) **Filtered Wastewater.** Filtered wastewater means an oxidized, coagulated, clarified wastewater which has been passed through natural undisturbed soils or filter media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units and does not exceed 5 turbidity units more than 5 percent of the time during any 24-hour period.

(s) **Disinfected Wastewater.** Disinfected wastewater means wastewater in which the pathogenic organisms have been destroyed by chemical, physical or biological means.

(t) **Multiple Units.** Multiple units means two or more units of a treatment process which operate in parallel and serve the same function.

(u) **Standby Unit Process.** A standby unit process is an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of providing comparable treatment for the entire design flow of the unit for which it is a substitute.

(v) **Power Source.** Power source means a source of supplying energy to operate unit processes.

(w) **Standby Power Source.** Standby power source means an automatically actuated self-starting alternate energy source maintained in immediately operable condition and of sufficient capacity to provide necessary service during failure of the normal power supply.

(x) **Standby Replacement Equipment.** Standby replacement equipment means reserve parts and equipment to replace broken-down or worn-out units which can be placed in operation within a 24-hour period.

(y) **Standby Chlorinator.** A standby chlorinator means a duplicate chlorinator for reclamation plants having one chlorinator and a duplicate of the largest unit for plants having multiple chlorinator units.

(z) **Multiple Point Chlorination.** Multiple point chlorination means that chlorine will be applied simultaneously at the reclamation plant and at subsequent chlorination stations located at the use area and/or some intermediate point. It does not include chlorine application for odor control purposes.

(aa) **Alarm.** Alarm means an instrument or device which continuously monitors a specific function of a treatment process and automatically gives warning of an unsafe or undesirable condition by means of visual and audible signals.

(bb) **Person.** Person also includes any private entity, city, county, district, the State or any department or agency thereof.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13521, Water Code.

History: 1. New Chapter 4 (§§ 60301–60357, not consecutive) filed 4-2-75; effective thirtieth day thereafter (Register 75, No. 14).

Article 2. Irrigation of Food Crops

60303. **Spray Irrigation.** Reclaimed water used for the spray irrigation of food crops shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.

60305. **Surface Irrigation.** (a) Reclaimed water used for surface irrigation of food crops shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

(b) Orchards and vineyards may be surface irrigated with reclaimed water that has the quality at least equivalent to that of primary effluent provided that no fruit is harvested that has come in contact with the irrigating water or the ground.

60307. **Exceptions.** Exceptions to the quality requirements for reclaimed water used for irrigation of food crops may be considered by the State Department of Health on an individual case basis where the reclaimed water is to be used to irrigate a food crop which must undergo extensive commercial, physical or chemical processing sufficient to destroy pathogenic agents before it is suitable for human consumption.

Article 3. Irrigation of Fodder, Fiber, and Seed Crops

60309. **Fodder, Fiber, and Seed Crops.** Reclaimed water used for the surface or spray irrigation of fodder, fiber, and seed crops shall have a level of quality no less than that of primary effluent.

60311. **Pasture for Milking Animals.** Reclaimed water used for the irrigation of pasture to which milking cows or goats have access shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

Article 4. Landscape Irrigation

60313. **Landscape Irrigation.** Reclaimed water used for the irrigation of golf courses, cemeteries, lawns, parks, playgrounds, freeway landscapes, and landscapes in other areas where the public has access shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

Article 5. Recreational Impoundments

60315. **Nonrestricted Recreational Impoundment.** Reclaimed water used as a source of supply in a nonrestricted recreational impoundment shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.

60317. **Restricted Recreational Impoundment.** Reclaimed water used as a source of supply in a restricted recreational impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

60319. **Landscape Impoundment.** Reclaimed water used as a source of supply in a landscape impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

Article 6. Sampling and Analysis

60321. **Sampling and Analysis.** (a) Samples for settleable solids and coliform bacteria, where required, shall be collected at least daily and at a time when wastewater characteristics are most demanding on the treatment facilities and disinfection procedures. Turbidity analysis, where required, shall be performed by a continuous recording turbidimeter.

(b) For uses requiring a level of quality no greater than that of primary effluent, samples shall be analyzed by an approved laboratory method of settleable solids.

(c) For uses requiring an adequately disinfected, oxidized wastewater, samples shall be analyzed by an approved laboratory method for coliform bacteria content.

(d) For uses requiring an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater, samples shall be analyzed by approved laboratory methods for turbidity and coliform bacteria content.

Article 7. Engineering Report and Operational Requirements

60323. **Engineering Report.** (a) No person shall produce or supply reclaimed water for direct reuse from a proposed water reclamation plant unless he files an engineering report.

(b) The report shall be prepared by a properly qualified engineer registered in California and experienced in the field of wastewater treatment, and shall contain a description of the design of the proposed reclamation system. The report shall clearly indicate the means for compliance with these regulations and any other features specified by the regulatory agency.

(c) The report shall contain a contingency plan which will assure that no untreated or inadequately-treated wastewater will be delivered to the use area.

60325. **Personnel.** (a) Each reclamation plant shall be provided with a sufficient number of qualified personnel to operate the facility effectively so as to achieve the required level of treatment at all times.

(b) Qualified personnel shall be those meeting requirements established pursuant to Chapter 9 (commencing with Section 13625) of the Water Code.

60327. **Maintenance.** A preventive maintenance program shall be provided at each reclamation plant to ensure that all equipment is kept in a reliable operating condition.

60329. **Operating Records and Reports.** (a) Operating records shall be maintained at the reclamation plant or a central depository within the operating agency. These shall include: all analyses specified in the reclamation criteria; records of operational problems, plant and equipment breakdowns, and diversions to emergency storage or disposal; all corrective or preventive action taken.

(b) Process or equipment failures triggering an alarm shall be recorded and maintained as a separate record file. The recorded information shall include the time and cause of failure and corrective action taken.

(c) A monthly summary of operating records as specified under (a) of this section shall be filed monthly with the regulatory agency.

(d) Any discharge of untreated or partially treated wastewater to the use area, and the cessation of same, shall be reported immediately by telephone to the regulatory agency, the State Department of Health, and the local health officer.

60331. Bypass. There shall be no bypassing of untreated or partially treated wastewater from the reclamation plant or any intermediate unit processes to the point of use.

Article 8. General Requirements of Design

60333. Flexibility of Design. The design of process piping, equipment arrangement, and unit structures in the reclamation plant must allow for efficiency and convenience in operation and maintenance and provide flexibility of operation to permit the highest possible degree of treatment to be obtained under varying circumstances.

60335. Alarms. (a) Alarm devices required for various unit processes as specified in other sections of these regulations shall be installed to provide warning of:

(1) Loss of power from the normal power supply.
(2) Failure of a biological treatment process.
(3) Failure of a disinfection process.
(4) Failure of a coagulation process.
(5) Failure of a filtration process.
(6) Any other specific process failure for which warning is required by the regulatory agency.

(b) All required alarm devices shall be independent of the normal power supply of the reclamation plant.

(c) The person to be warned shall be the plant operator, superintendent, or any other responsible person designated by the management of the reclamation plant and capable of taking prompt corrective action.

(d) Individual alarm devices may be connected to a master alarm to sound at a location where it can be conveniently observed by the attendant. In case the reclamation plant is not attended full time, the alarm(s) shall be connected to sound at a police station, fire station or other full-time service unit with which arrangements have been made to alert the person in charge at times that the reclamation plant is unattended.

60337. Power Supply. The power supply shall be provided with one of the following reliability features:

(a) Alarm and standby power source.

(b) Alarm and automatically actuated short-term retention or disposal provisions as specified in Section 60341.

(c) Automatically actuated long-term storage or disposal provisions as specified in Section 60341.

Article 9. Alternative Reliability Requirements for Uses Permitting Primary Effluent

60339. Primary Treatment. Reclamation plants producing reclaimed water exclusively for uses for which primary effluent is permitted shall be provided with one of the following reliability features:

(a) Multiple primary treatment units capable of producing primary effluent with one unit not in operation.

(b) Long-term storage or disposal provisions as specified in Section 60341.

Article 10. Alternative Reliability Requirements for Uses Requiring Oxidized, Disinfected Wastewater or Oxidized, Coagulated, Clarified, Filtered, Disinfected Wastewater

60341. Emergency Storage or Disposal. (a) Where short-term retention or disposal provisions are used as a reliability feature, these shall consist of facilities reserved for the purpose of storing or disposing of untreated or partially treated wastewater for at least a 24-hour period. The facilities shall include all the necessary diversion devices, provisions for odor control, conduits, and pumping and pump back equipment. All of the equipment other than the pump back equipment shall be either independent of the normal power supply or provided with a standby power source.

(b) Where long-term storage or disposal provisions are used as a reliability feature, these shall consist of ponds, reservoirs, percolation areas, downstream sewers leading to other treatment or disposal facilities or any other facilities reserved for the purpose of emergency storage or disposal of untreated or partially treated wastewater. These facilities shall be of sufficient capacity to provide disposal or storage of wastewater for at least 20 days, and shall include all the necessary diversion works, provisions for odor and nuisance control, conduits, and pumping and pump back equipment. All of the equipment other than the pump back equipment shall be either independent of the normal power supply or provided with a standby power source.

(c) Diversion to a less demanding reuse is an acceptable alternative to emergency disposal of partially treated wastewater provided that the quality of the partially treated wastewater is suitable for the less demanding reuse.

(d) Subject to prior approval by the regulatory agency, diversion to a discharge point which requires lesser quality of wastewater is an acceptable alternative to emergency disposal of partially treated wastewater.

(e) Automatically actuated short-term retention or disposal provisions and automatically actuated long-term storage or disposal provisions shall include, in addition to provisions of (a), (b), (c), or (d) of this section, all the necessary sensors, instruments, valves and other devices to enable fully automatic diversion of untreated or partially treated wastewater to approved emergency storage or disposal in the event of failure of a treatment process, and a manual reset to prevent automatic restart until the failure is corrected.

60343. Primary Treatment. All primary treatment unit processes shall be provided with one of the following reliability features:

(a) Multiple primary treatment units capable of producing primary effluent with one unit not in operation.

(b) Standby primary treatment unit process.

(c) Long-term storage or disposal provisions.

60345. Biological Treatment. All biological treatment unit processes shall be provided with one of the following reliability features:

(a) Alarm and multiple biological treatment units capable of producing oxidized wastewater with one unit not in operation.

(b) Alarm, short-term retention or disposal provisions, and standby replacement equipment.

(c) Alarm and long-term storage or disposal provisions.

(d) Automatically actuated long-term storage or disposal provisions.

60347. Secondary Sedimentation. All secondary sedimentation unit processes shall be provided with one of the following reliability features:

(a) Multiple sedimentation units capable of treating the entire flow with one unit not in operation.

(b) Standby sedimentation unit process.

(c) Long-term storage or disposal provisions.

60349. Coagulation.

(a) All coagulation unit processes shall be provided with the following mandatory features for uninterrupted coagulant feed:

(1) Standby feeders,
(2) Adequate chemical storage and conveyance facilities,
(3) Adequate reserve chemical supply, and
(4) Automatic dosage control.

(b) All coagulation unit processes shall be provided with one of the following reliability features:

(1) Alarm and multiple coagulation units capable of treating the entire flow with one unit not in operation;

(2) Alarm, short-term retention or disposal provisions, and standby replacement equipment;

(3) Alarm and long-term storage or disposal provisions;

(4) Automatically actuated long-term storage or disposal provisions; or

(5) Alarm and standby coagulation process.

60351. Filtration. All filtration unit processes shall be provided with one of the following reliability features:

(a) Alarm and multiple filter units capable of treating the entire flow with one unit not in operation.

(b) Alarm, short-term retention or disposal provisions and standby replacement equipment.

(c) Alarm and long-term storage or disposal provisions.

(d) Automatically actuated long-term storage or disposal provisions.

(e) Alarm and standby filtration unit process.

60353. Disinfection.

(a) All disinfection unit processes where chlorine is used as the disinfectant shall be provided with the following features for uninterrupted chlorine feed:

(1) Standby chlorine supply,
(2) Manifold systems to connect chlorine cylinders,
(3) Chlorine scales, and
(4) Automatic devices for switching to full chlorine cylinders.

Automatic residual control of chlorine dosage, automatic measuring and recording of chlorine residual, and hydraulic performance studies may also be required.

(b) All disinfection unit processes where chlorine is used as the disinfectant shall be provided with one of the following reliability features:

(1) Alarm and standby chlorinator;

(2) Alarm, short-term retention or disposal provisions, and standby replacement equipment;

(3) Alarm and long-term storage or disposal provisions;

(4) Automatically actuated long-term storage or disposal provisions; or

(5) Alarm and multiple point chlorination, each with independent power source, separate chlorinator, and separate chlorine supply.

60355. Other Alternatives to Reliability Requirements. Other alternatives to reliability requirements set forth in Articles 8 to 10 may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the proposed alternative will assure an equal degree of reliability.

Article 11. Other Methods of Treatment

60357. Other Methods of Treatment. Methods of treatment other than those included in this chapter and their reliability features may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the methods of treatment and reliability features will assure an equal degree of treatment and reliability.

The following guidelines have been published by the State Health Department to minimize the public health risks in irrigating with reclaimed wastewater. They are guidelines only and do not have the force of law, but are designed to aid irrigators who wish to reuse wastewater on crops or landscape.

STATE OF CALIFORNIA DEPARTMENT OF HEALTH

GUIDELINES FOR USE OF RECLAIMED WATER FOR SPRAY IRRIGATION OF CROPS

1. Reclaimed water shall meet the Regional Water Quality Control Board requirements and the quality requirements established by the State of California Department of Health for health protection.

2. The discharge shall be confined to the area designated and approved for disposal and reuse. Irrigation should be controlled to minimize ponding of wastewater and runoff should be contained and properly disposed.

3. Maximum attainable separation of reclaimed water lines and domestic water lines shall be practiced. Domestic and reclaimed water transmission and distribution mains shall conform to the "Separation and Construction Criteria" (see attached).

    a. The use area facilities must comply with the "Regulations Relating to Cross-Connections," Title 17, Chapter V, Sections 7583-7622, inclusive, California Administrative Code.

    b. Plans and specifications of the existing and proposed reclaimed water system and domestic water system shall be submitted to State and/or local health agencies for review and approval.

4. All reclaimed water valves and outlets should be appropriately tagged to warn the public that the water is not safe for drinking or direct contact.

5. All piping, valves, and outlets should be color-coded or otherwise marked to differentiate reclaimed water from domestic or other water.

    a. Where feasible, differential piping materials should be used to facilitate water system identification.

6. All reclaimed water valves and outlets should be of a type that can only be operated by authorized personnel.

7. Adequate means of notification shall be provided to inform the public that reclaimed water is being used. Conspicuous warning signs with proper wording of sufficient size to be clearly read shall be posted at adequate intervals around the use area.

8. Irrigation should be done so as to prevent or minimize contact by the public with the sprayed material and precautions should be taken to insure that reclaimed water will not be sprayed on walkways, passing vehicles, buildings, domestic water facilities, or areas not under control of the user.

    a. The irrigated areas should be fenced where primary effluent is used.

b. Windblown spray from the irrigation area should not reach areas accessible to the public.

c. Irrigated areas must be kept completely separated from domestic water wells and reservoirs. A minimum of 500 feet should be provided.

9. Adequate measures should be taken to prevent the breeding of flies, mosquitoes and other vectors of public health significance during the process of reuse.

10. Operation of the use area facilities should not create odors, slimes, or unsightly deposits of sewage origin.

11. Adequate time should be provided between the last irrigation and harvesting to allow the crops and soil to dry.

a. Animals, especially milking animals, should not be allowed to graze on land irrigated with reclaimed water until it is thoroughly dry.

12. There should be no subsequent planting of produce on lands irrigated with primary effluent.

JC:gm
9/10/74

STATE OF CALIFORNIA DEPARTMENT OF HEALTH

GUIDELINES FOR USE OF RECLAIMED WATER FOR SURFACE IRRIGATION OF CROPS

1. Reclaimed water shall meet the Regional Water Quality Control Board requirements and the quality requirements established by the State of California Department of Health for health protection.

2. The discharge shall be confined to the area designated and approved for disposal and reuse. Irrigation should be controlled to minimize ponding of wastewater and runoff should be contained and properly disposed.

3. Maximum attainable separation of reclaimed water lines and domestic water lines shall be practiced. Domestic and reclaimed water transmission and distribution mains shall conform to the "Separation and Construction Criteria" (see attached).

    a. The use area facilities must comply with the "Regulations Relating to Cross-Connections," Title 17, Chapter V, Sections 7583-7622, inclusive, California Administrative Code.

    b. Plans and specifications of the existing and proposed reclaimed water system and domestic water system shall be submitted to State and/or local health agencies for review and approval.

4. All reclaimed water valves and outlets should be appropriately tagged to warn the public that the water is not safe for drinking or direct contact.

5. All piping, valves, and outlets should be color-coded or otherwise marked to differentiate reclaimed water from domestic or other water.

    a. Where feasible, differential piping materials should be used to facilitate water system identification.

6. All reclaimed water valves and outlets should be of a type that can only be operated by authorized personnel.

7. Adequate means of notification shall be provided to inform the public that reclaimed water is being used. Conspicuous warning signs with proper wording of sufficient size to be clearly read shall be posted at adequate intervals around the use area.

8. The public shall be effectively excluded from contact with the reclaimed water used for irrigation.

    a. The irrigated areas should be fenced where primary effluent is used.

b. Irrigated areas must be kept completely separated from domestic water wells and reservoirs. A minimum of 500 feet should be provided.

9. Adequate measures should be taken to prevent the breeding of flies, mosquitoes and other vectors of public health significance during the process of reuse.

10. Operation of the use area facilities should not create odors, slimes, or unsightly deposits of sewage origin.

11. Adequate time should be provided between the last irrigation and harvesting to allow the crops and soil to dry.

    a. Animals, especially milking animals, should not be allowed to graze on land irrigated with reclaimed water until it is thoroughly dry.

12. There should be no subsequent planting of produce on lands irrigated with primary effluent.

13. Adequate measures shall be taken to prevent any direct contact between the edible portion of the crops and the reclaimed water.

JC:gm
9/10/74

STATE OF CALIFORNIA DEPARTMENT OF HEALTH

GUIDELINES FOR USE OF RECLAIMED WATER FOR LANDSCAPE IRRIGATION

1. Reclaimed water shall meet the Regional Water Quality Control Board requirements and the quality requirements established by the State of California Department of Health for health protection.

2. The discharge shall be confined to the area designated and approved for disposal and reuse. Irrigation should be controlled to minimize ponding of wastewater and runoff should be contained and properly disposed.

3. Maximum attainable separation of reclaimed water lines and domestic water lines shall be practiced. Domestic and reclaimed water transmission and distribution mains shall conform to the "Separation and Construction Criteria" (see attached).

    a. The use area facilities must comply with the "Regulations Relating to Cross-Connections," Title 17, Chapter V, Sections 7583-7622, inclusive, California Administrative Code.

    b. Plans and specifications of the existing and proposed reclaimed water system and domestic water system shall be submitted to State and/or local health agencies for review and approval.

4. All reclaimed water valves, outlets and/or sprinkler heads should be appropriately tagged to warn the public that the water is not safe for drinking or direct contact.

5. All piping, valves, and outlets should be color-coded or otherwise marked to differentiate reclaimed water from domestic or other water.

    a. Where feasible, differential piping materials should be used to facilitate water system identification.

6. All reclaimed water valves, outlets, and sprinkler heads should be of a type that can only be operated by authorized personnel.

    a. Where hose bibbs are present on domestic and reclaimed water lines, differential sizes should be established to preclude the interchange of hoses.

7. Adequate means of notification shall be provided to inform the public that reclaimed water is being used. Such notification should include the posting of conspicuous warning signs with proper wording of sufficient size to be clearly read. At golf courses, notices should also be printed on score cards and at all water hazards containing reclaimed water.

8. Tank trucks used for carrying or spraying reclaimed water should be appropriately identified to indicate such.

9. Irrigation should be done so as to prevent or minimize contact by the public with the sprayed material and precautions should be taken to insure that reclaimed water will not be sprayed on walkways, passing vehicles, buildings, picnic tables, domestic water facilities, or areas not under control of the user.

    a. Irrigation should be practiced during periods when the grounds will have maximum opportunity to dry before use by the public unless provisions are made to exclude the public from areas during and after spraying with reclaimed water.

    b. Windblown spray from the irrigation area should not reach areas accessible to the public.

    c. Irrigated areas must be kept completely separated from domestic water wells and reservoirs. A minimum of 500 feet should be provided.

    d. Drinking water fountains should be protected from direct or windblown reclaimed water spray.

10. Adequate measures should be taken to prevent the breeding of flies, mosquitoes and other vectors of public health significance during the process of reuse.

11. Operation of the use area facilities should not create odors, slimes, or unsightly deposits of sewage origin in places accessible to the public.

JC:gm
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STATE OF CALIFORNIA DEPARTMENT OF HEALTH

GUIDELINES FOR USE OF RECLAIMED WATER FOR IMPOUNDMENTS

1. Reclaimed water shall meet the Regional Water Quality Control Board requirements and the quality requirements established by the State of California Department of Health for health protection.

2. The discharge shall be confined to the area designated and approved for disposal and reuse. Runoff should be contained and properly disposed.

3. Maximum attainable separation of reclaimed water lines and domestic water lines shall be practiced. Domestic and reclaimed water transmission and distribution mains shall conform to the "Separation and Construction Criteria" (see attached).

    a. The use area facilities must comply with the "Regulations Relating to Cross-Connections," Title 17, Chapter V, Sections 7583-7622, inclusive, California Administrative Code.

    b. Plans and specifications of the existing and proposed reclaimed water system and domestic water system shall be submitted to State and/or local health agencies for review and approval.

4. At restricted recreational impoundments and landscape impoundments all valves and outlets should be appropriately tagged to warn the public that the water is not safe for drinking or bathing.

5. At non-restricted recreational impoundments all valves and outlets should be appropriately tagged to warn the public that the water is reclaimed from sewage and is not safe for drinking.

6. All piping, valves, and outlets should be color-coded or otherwise marked to differentiate reclaimed water from domestic or other water.

    a. Where feasible, differential piping materials should be used to facilitate water system identification.

7. All reclaimed water valves and outlets should be of a type that can only be operated by authorized personnel.

8. Adequate means of notification shall be provided to inform the public that reclaimed water is being used. Such notification should include the posting of conspicuous warning signs with proper wording of sufficient size to be clearly read.

9. Adequate measures shall be taken to prevent body-contact activities, such as wading or swimming, at restricted recreational impoundments containing reclaimed water.

10. Adequate measures shall be taken to prevent direct public contact with reclaimed water at landscape impoundments.

11. Restricted and non-restricted recreational impoundments shall be maintained under the continuous supervision of qualified personnel during periods of use.

12. Impoundments containing reclaimed water must be kept completely separated from domestic water wells and reservoirs. A minimum of 500 feet should be provided.

13. Adequate measures should be taken to prevent the breeding of flies, mosquitoes and other vectors of public health significance during the process of reuse.

14. Operation of the use area facilities should not create odors, slimes, or unsightly deposits of sewage origin in places accessible to the public.

JC:gm
9/10/74

STATE OF CALIFORNIA DEPARTMENT OF HEALTH

GUIDELINES FOR WORKER PROTECTION
AT WATER RECLAMATION USE AREAS

1. Employees should be made aware of the potential health hazards involved with contact or ingestion of reclaimed water.

2. Employees should be subjected to periodic medical examinations for intestinal diseases and to adequate immunization shots.

3. Adequate first aid kits should be available on location, and all cuts and abrasions should be treated promptly to prevent infection. A doctor should be consulted where infection is likely.

4. Precautionary measures should be taken to minimize direct contact of employees with reclaimed water.

    a. Employees should not be subjected to reclaimed water sprays.

    b. For work involving more than a casual contact with reclaimed water, employees should be provided with protective clothing.

    c. At crop irrigation sites, the crops and soil should be allowed to dry before harvesting by employees.

5. Provisions should be made for a supply of safe drinking water for employees. Where bottled water is used for drinking purposes, the water should be in contamination-proof containers and protected from contact with reclaimed water or dust.

    a. The water should be of a source approved by the local health authority.

6. Toilet and washing facilities should be provided.

7. Precautions should be taken to avoid contamination of food taken to areas irrigated with reclaimed water, and food should not be taken to areas still wet with reclaimed water.

8. Adequate means of notification shall be provided to inform the employees that reclaimed water is being used. Such notification should include the posting of conspicuous warning signs with proper wording of sufficient size to be clearly read.

    a. In some locations, especially at crop irrigation use areas, it is advisable to have the signs in Spanish as well as English.

9. All reclaimed water valves, outlets, and/or sprinkler heads should be appropriately tagged to warn employees that the water is not safe for drinking or direct contact (direct contact is allowed at non-restricted recreational impoundments).

10. All piping, valves and outlets should be color-coded or otherwise marked to differentiate reclaimed water from domestic or other water.

    a. Where feasible, differential piping materials should be used to facilitate water system identification.

11. All reclaimed water valves, outlets and sprinkler heads should be of a type that can only be operated by authorized personnel.

    a. Where hose bibbs are present on domestic and reclaimed water lines, differential sizes should be established to preclude the interchange of hoses.

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9/10/74

SEPARATION AND CONSTRUCTION CRITERIA
DOMESTIC AND RECLAIMED WASTEWATER TRANSMISSION AND DISTRIBUTION MAINS

BASIC SEPARATION		WATER MAIN INVOLVED		RECLAIMED WASTEWATER MAIN CONSTRUCTION MINIMUM SEPARATION IF BASIC SEPARATION IS NOT FEASIBLE		
Parallel Construction	Perpendicular Construction	Reclaimed Wastewater	Domestic Water	Parallel Construction	Perpendicular Construction Reclaimed wastewater main above domestic water main	Perpendicular Construction Reclaimed wastewater main below domestic water main Clearance less than three (3) feet
(a) 25'	(b) 3'	Pressure	(c) Gravity	No Exception	Minimum pipe class 2 x wwp; Steel casing 25' both sides of crossing	Minimum pipe class 2 x wwp; Steel casing 25' both sides of crossing
25'	3'	Gravity	Gravity	VCP, AC, CIP, or equal, class 150; 15' minimum separation; Mechanical compression joints	Steel casing 25' both sides of crossing	VCP, AC, CIP, or equal, class 150; Mechanical compression joints 25' both sides of crossing
10'	3'	Pressure	Pressure	Minimum pipe class 2 x wwp; 4' minimum separation; no common trench	Minimum pipe class 2 x wwp; Mechanical compression joints 4' both sides of crossing	Minimum pipe class 2 x wwp; Mechanical compression joints 4' both sides of crossing
10'	3'	Gravity	Pressure	VCP; Mechanical compression joints 4' minimum separation	Concrete encasement or steel casing 4' both sides of crossing	VCP, AC, CIP; Mechanical compression joints 4' both sides of crossing

(a) All distances measured from pipeline O.D.
(b) Domestic water main 3' above reclaimed wastewater main.
(c) Less than 5 psi.